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SKATES' EGGS AND YOUNG.

BY F. W. PUTNAM.

It is an interesting fact that while the class of bony, or *true* Fishes, both fresh water and marine, are, with very few exceptions, oviparous, and lay immense numbers of eggs, the *Selachians*, or sharks and skates and their allies, are, with equally few exceptions, viviparous, and bring forth but few young at a time. One of the exceptions to the rule of viviparity among the Selachians is the genus *Raja*, to which our common species of skates and rays belong. Though the fact that skates lay eggs has been known for centuries, still to this day there is probably no class of objects picked up by the wanderer on the sea beach that excites curiosity so much as the egg cases of the several species of skates, after he has found out what they are. On being seen for the first time, and before close examination, I venture to state that the majority of persons regard them as some vegetable production, and pass them by as the supposed "bladder" of the seaweed with which they are often so closely connected by their tendrils as to have the appearance of being part of the plant, which they also greatly resemble in color and general appearance.

Some sharp eyed fisherman long ago, ascertaining that the

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queer shaped things which he found on the beach were in fact little pockets, or sacks opened at one end, not knowing what else they could be, concluded that in some way they must be connected with the "maids of the ocean;" and what more natural than to suppose them to be the purses to hold the pearls and other valuables of the mysterious maids? and what better name than "Mermaid purses" could be desired? From this first christening, and following the common rule adopted for such cases—that of keeping as far away as possible from the real nature of the object—they have been called, and are generally known as "sea purses" and "sailor's purses." The only popular name bearing on their real origin is that given to them on some portions of the English coast, where they are called "skate barrows," from their resemblance in form to a hand-barrow, and the knowledge of the christener that they were produced by the skates.

As common as these egg cases are on our beaches, it is very seldom, and only at certain seasons, that they are found containing the egg or embryo. When fresh and filled by the embryo they are plump and swollen and of a much lighter olive color than when empty, dry and shrivelled. As long as the embryo is in the case no opening to the pouch can be detected, until just at the time when the young skate is to make his way into the world and commence his struggle for existence, consisting principally in keeping himself from going into the ever ready mouths of his own kin of fin, to whom he forms a tempting morsel. Just as incubation comes to a close, then, the substance at one end of the case softens and the upper and under layers are pushed apart by the young skate who "noses" his way out; the two layers then spring back into place and the case on drying shows no sign of an opening, unless it is again softened and the layers carefully separated.

We do not yet know the breeding season of our species, but Pennant in his "British Zoölogy," states that the "skates generate in March and April, at which time they swim near

the surface of the water, several of the males pursuing one female; and adhere so fast during coition, that the fishermen frequently draw up both together, though only one has taken the bait. The females begin to cast their *purses* in May, and continue doing so till September. In October they are exceedingly poor and thin, but in November they begin to improve, and grow gradually better till May, when they are in the highest perfection. The males go sooner out of season than the females."

We extend this quotation from Pennant to take in that part of the paragraph relating to the *condition* of the fish purposely, in order to call attention to the great waste of food on our New England coast. Here, to tell a person that a skate is good eating is about the same as to tell him that the horse is good eating. His reply will be, "you may eat it if you wish but I would rather have something else," and yet the skate and the horse are good wholesome food, which we should probably enjoy after we got used to it. In many parts of Great Britain and France, to say nothing of China, skates of a tender age, *i.e.*, about half grown, when they are called "maids," and also many sharks are considered good and wholesome food, and are regularly sold in the markets. Our Celestial friends on the Pacific coast have brought skates and sharks into demand in that region, and in time we shall have the benefit of their custom here, when skates and sharks will be caught for other purposes than the making of "pure Cod liver oil;" but until the Celestial element predominates over the Celtic, salt-cod and herrings will hold sway over the poor Selachians now condemned to die for their *livers* sake alone.

Another clause in the quotation from Pennant leads us to say a word or two, before turning again to our skates' eggs.

The male skates and sharks have appendages to the ventral fins which have been called claspers, from their supposed use in the act of coition. These appendages are in reality the intromittent organs of the male, and what were called

the legs of the monster shark exhibited about the country during the last two seasons, and familiar to every one from the newspaper descriptions and figures as "the great unknown animal, half fish, half quadruped," captured off Eastport, were simply these organs.

The skates and rays and the genus *Scyllium*, or spotted sharks, and their near allies, all lay eggs, contained in and protected by the singular horny cases, or shells. These cases are of various sizes and shapes according to the species of skate or shark by which they are laid. Their general form is that of the skates' figured in this article, but others are much larger, and those of the sharks are longer and narrower than the skates. On the coast of California a very large case is often found which always contains more than one egg, generally three. I remember one, received at the Museum of Comparative Zoölogy about twelve years since, that was several inches in length and contained three nearly developed embryos.

All these egg cases are provided with a more or less developed horn at each of the four corners. These horns are hollow, and are in fact tubes for the passage of water to the inside of the case and its exit at the other extremity of the sack. By this means the egg and tender embryo while protected by the horny covering or case, is furnished with a constant supply of water during its development. On the side of the case are numerous tendrils or filaments, by which the case is firmly fastened to seaweed, and hence it is that it is only after a violent storm that fresh cases are to be found on our beaches.

A few interesting questions which have not yet been fully solved, are: How do the cases become attached to the seaweed? Are the tendrils fastened by the mother skate in any way, or are they, when soft and fresh, so arranged that they naturally twine around the seaweed as soon as they come in contact with it? Does the skate when about to deposit her eggs go to a spot where seaweed is abundant, or

does she cast them at random and trust to the cases drifting to some suitable place for attachment?

That the mother when about to deposit her eggs selects a proper place for their attachment, just as other species go to regular spawning grounds, is, I think, proved by Mr. Thompson in his "Natural History of Ireland," who even asks the question if it is not probable that, like certain species of birds, the same fish (in this instance one of the spotted sharks) may return time after time to the same spot to deposit her eggs. This query arose from the fact that there were sent to him in December, 1843, two plants of the tangle (*Laminaria digitata*) dredged together from a depth of between two and three fathoms, to one of which was attached fourteen of the large ova and to the other twelve. "Of the fourteen six were very old [and empty], six of middle age [and empty], and two quite fresh [*i.e.*, with undeveloped eggs]. Of the twelve on the other plant, four were very old, four of middle age, and four were fresh." Now if this does not prove that all these eggs were deposited at three different seasons by the same fish—which, with Mr. Thompson, I believe is probable—it certainly proves that the fishes seek a proper place for the attachment of their eggs and do not leave them to the mercy of tide and wave.

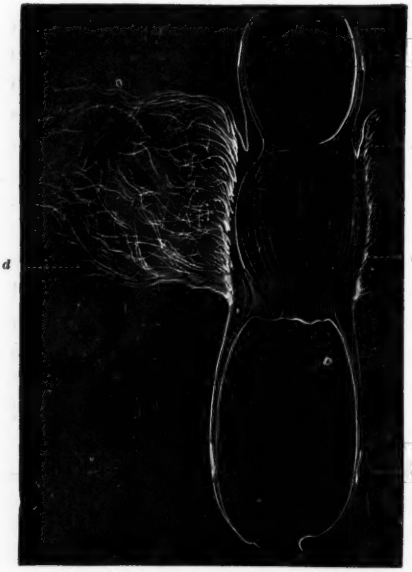
In January, 1864, Professor Jeffries Wyman communicated the results of his "Observations on the Development of *Raia batis*" to the American Academy of Science and Arts, and the article is printed in the Memoirs of the Academy for that year. These "Observations" contain all that is known relating to the development of the common skate of our coast, and should be read by every one interested in the subject.

Professor Wyman has granted me the use of the woodcuts illustrating his article, and rather than rewrite, abstract, and otherwise pilfer from his paper, I shall, with this acknowledgment, make extended quotations from his Memoir, and

add the explanations to the figures which he has so kindly placed at my disposal for this article.

"*Egg case.*—This singular structure has the general form of such parts in egg-laying Selachians. The whole case, in the species here described is between six and seven inches in length, of a deep greenish-brown color, and composed of minute parallel filaments, which give it a striated appearance and a silky lustre. The central pouch (fig. 85, *a*), for the protection of the yelk and the embryo, is about two inches long, an inch and a half wide, bulges in the middle, and has a hollow, slender, curved horn projecting from each corner. The fore end of the pouch is deeply concave, and thickest, while the hinder is thin, nearly square, and ragged; it is from this part that the embryo escapes, after the separation of the upper and under walls from each other. The hinder horns project backwards as they lie in the oviduct, and are of about twice the length of those at the other end. The outer edge of each horn is the more rounded, and near the free end has an oblong slit (*b b'*) for the inward and outward flow of the water which passes through the egg during incubation.

Fig. 85.



Egg case of Skate, one-half natural size; *a*, pouch for the yelk; *b b'*, openings for the inward and outward flow of water; *c*, spur; *d*, membrane formed by the interweaving of the lateral filaments.

At the base of each fore horn is a slender projection or spur (*c*), about half an inch in length, the whole outer border of which breaks up into a series of silky filaments, and these are especially abundant near the free end. Similar filaments are given off from the whole border of the capsule, and all become tangled and woven together in such a manner as to form a broad and somewhat thick membrane on each side (*d*). This membrane was found entire only on cases taken from the oviduct, and on those newly laid. In all such, however, as have embryos somewhat advanced, it is more or less destroyed, and for the most part only tufts of it remain at the base of each horn. The

object of it is not apparent, unless it be to assist in securing an anchorage, by the entanglement of its filaments with submarine plants or rough surfaces.

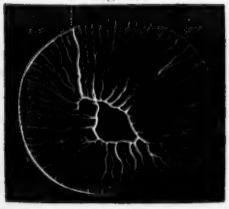
In a single instance, in the dissection of skates, an imperfect egg-case was found in each oviduct, the development of it having just begun. The hinder horns and the hinder edge of the capsule were the only parts completed. They were contained in the glandular portion of the oviduct, which is quite thick during the reproductive season, and is mostly made up of very minute and slender follicles, of great length. From some of them fibrils protruded, identical in structure with those out of which the cases are made, and which, after being liberated, are doubtless moulded into the shape of these cases, and cemented together by some secretion from the oviduct. The horns are formed in grooves on either side of the duct, and the pouch for the yelk in the intervening space. A careful examination of the ovary and oviduct in the above instance showed the singular fact, that, although some of the yelks were mature, none had as yet been detached from the ovisacs. This circumstance renders it probable, that, after the horny pouch is partially formed, the yelk descends and enters it, and that then the other portions are completed. If this supposition, based upon a single observed instance, were to be confirmed by further examinations, it would prove the existence of an interesting deviation from a rule among animals generally supposed to be without exception, viz.: that the presence of the yelk in the oviduct is necessary before the formation of the egg-coverings can begin.

Fig. 86. *c*

a *d*

Eel-shaped embryo of Skate, connected with the yelk by a slender umbilical cord; *a*, omphalo-mesenteric artery; *c*, dorsal fins; *d*, anal fin.

a Fig. 87.



Under side of the yelk of fig. 86, showing the continuation of the artery, *a*, and the connecting with the triangular terminal sinus.

In none of the cases which we have examined have we found the fœtus surrounded either by a membrane or by albuminous matter, but in every instance the yelk and the embryo were fully exposed to contact with the water, which entered by the openings already described. An albuminous covering may have existed at an earlier period, and have been absorbed."

"*Yelk.*—After the body of the embryo has become well defined, it is attached to the yelk by a slender umbilical cord about half an inch in length (fig. 86). The yelk has not the pyriform shape so common in other

Selachians, but is nearly spherical, though somewhat flattened above and below. The cord has the length just mentioned only temporarily, and soon begins to shorten, and contracts until the fœtus rests once more upon the surface of the yelk (figs. 91 and 93). The two omphalo-mesenteric vessels, common to all vertebrates, carry the blood from the embryo to the yelk and back. The artery, a branch of the mesenteric (figs 86 and 93, *a*), passes out beneath the head, over the front of the yelk, and descends to the under surface, giving off minute twigs to the right and left; but the trunk itself does not branch. Dr. John Davy, in his observations on the development of the torpedo, although he figures a vein surrounding the vascular area in the younger specimens, yet makes no reference to it in the text. Agassiz has observed a similar vessel in the yelk of a dog-fish, and has for the first time pointed out its resemblance to the *sinus terminalis* of birds. Dr. Davy's figures, taken in connection with those here given, form a complete series. In the youngest of the specimens described by him the sinus is found on the upper surface of the yelk, and quite near the embryo; in the second, it has receded towards the sides, and the vascular area enlarged to a corresponding degree. In our specimens it is found on the under surface, is of a triangular form (fig. 87), and encloses only a small area. Eventually it contracts still further, and at last wholly disappears, and thus the entire surface of the yelk becomes vascular (figs. 91 and 93).

Fig. 88.

Embryo of Skate, more advanced than fig. 86, a ventral view, showing the pectoral fins, *a*; the ventral fins, *b*; and the temporary anal fin, *d*.

As development advances the yelk is gradually withdrawn into the cavity of the abdomen, as in birds; but the retraction does not appear to be quite complete in the skates until a short time after hatching. In one instance a fully formed skate taken from the egg-case had the yelk reduced to a small flattened mass about two lines in diameter. Very nearly the same condition existed in another, which was already hatched. In a third instance, where the young had been hatched for a longer time, the yelk had been wholly introduced into the cavity of the abdomen; but a considerable mass of it, still within the abdominal cavity, remained to be absorbed (fig. 96, *a*), where, as in the newly hatched chick, it serves as a reservoir of nourishment. Dr. Davy states that, in the torpedo, the young fish is nourished by the yelk for six weeks after birth. In all cases we have found the vitelline duct entering the intestine just above the spiral valve."

"*Form of the Fœtus.*—The general form of the youngest specimen is long, slender, and gradually tapers to a point backward, as in fig. 86, and may be described in one word as eel-shaped. The head presents two rounded projections, one of them forward (figs. 89 and 90, *d*), forming the

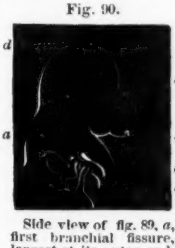
foremost part of the embryo; this is made by the protrusion of the optic lobes, and closely resembles the same part in the embryos of birds; the second (fig. 90, *e*) is directed downward, and contains the cerebral and olfactory lobes behind which are the eyes. These last, which in the earlier stages, as in figs. 86, 88, 92, are on the same level with the surrounding parts, soon become remarkably prominent, as in fig. 94, where they remind us of the eyes of the young of Malleus.* In the fully formed fish they are again reduced to nearly the same level with the adjoining integuments. As development advances, the optic lobes cease to form the most prominent part of the head, in consequence of a change of position of the cerebral hemispheres, which rise to the same level with the organs just mentioned, as the facial disk (figs. 93, 95, 92, *b*) advances beneath them. In fig. 91 the embryo has many of the features of a shark; and in fig. 94, with the expansion of the pectoral and ventral fins, it begins to take on the form of the skate."

Fig. 89.

Head of fig. 88, enlarged, showing the first branchial arch *b*, without fringes; the mouth in open space between the first branchial arches; *d*, projection of the optic lobes; *e*, projection of the cerebral lobes.

"*Fins.*—In the youngest specimen examined (fig. 86), a vertical fold of skin stretches along the middle line, from near the head almost to the end of the tail above, and from near the umbilical cord to the same point below. These folds do not pass beyond or become connected around the end of the tail. The dorsals (figs. 86 and 93, *c*) are formed by two vertical extensions of the upper fold, and in this early stage of their existence are placed midway between the base of the tail and its tip, which last tapers to a slender point. The anals (figs. 86, 93, and 95, *d*) are formed from a similar extension of the under fold, and are situated somewhat further forward than are the dorsals. The first (fig. 91, *d*) grows very rapidly, and soon acquires a disproportionately large size; but the second (fig. 91, *d'*) is quite diminutive. Both upper and lower folds and fins have their edges bordered with follicles.

Fig. 90.



Side view of fig. 89. *a*, first branchial fissure, largest at its outer end, which portion corresponds with the future spiracle; *b*, the inner end; the first arch is in front of this fissure; *b'*, the second fissure, in front of which is the second arch, bearing a fringe; *c*, nasal fossa; *d*, projection of the optic lobes; *e*, cerebral lobes.

Both dorsal and anal fins undergo a very remarkable change as development advances. The first in the adult are found quite at the end of the tail, instead of the middle, as in the early stage. This change of relative position seems to be effected in part by the more rapid growth of that portion of the tail which is in front of them, while that which is behind scarcely increases in size, and thus

* Hammer-headed shark.

the fins are soon nearer the end than the middle. At the time of hatching, the terminal portion is still present (fig. 96, *c*); but subsequently it is either absorbed, or, what is not improbable, is covered by the extension of the dorsals backward.

The anal fins, the first of which, as already stated, attains to a remarkably large size, are gradually absorbed, and are wholly removed before the end of gestation. From the fact of these fins having a temporary existence in the skate, and a permanent one in many sharks, it is not improbable that they may be present in the embryos of all Plagiostomes.

Fig. 91.

Embryo of Skate at the Shark-shaped stage. *c*, the dorsal fins; *d*, *d'*, the anal fins.

This development, temporary existence, and early removal of the anal fins, gives us another interesting example of the formation of parts which have no obvious use in the economy, and which must be regarded as having merely a morphological value. It falls into the same category with the caudal fin of the embryo of Pipa,* which is never used, the teeth of certain Cetaceans, the inferior incisors of the female Mastodon, which are all removed without being used, and the milk incisors of the Guinea-pig, which are shed *in utero*.

There is still another point of interest in the morphology of the tail of the species we are here considering; for although symmetrical, it does not at any period assume the heterocercal form, but retains permanently its primary embryonic or protocercal condition.

In this respect the skates hold a lower position than the sharks, nearly all of whom pass through the protocercal into the heterocercal stage.

Fig. 92.

Head of fig. 91, enlarged. *a*, nasal lobe; *b*, facial disk; *c*, upper lip.

The pectoral and ventral fins begin as slight ridges on either side, but each soon takes on the form of a half oval disk (fig. 88, *a*, *b*). At first the two are nearly continuous in the same plane (fig. 88), but the pectorals (figs. 94 and 95, *a*) grow the most rapidly, gradually assume a somewhat oblique position, and in a short time partially cover the ventrals. None of the specimens were of a proper age to show whether or not the pectorals were formed first, as is the case with the fore limbs of all the vertebrates whose de-

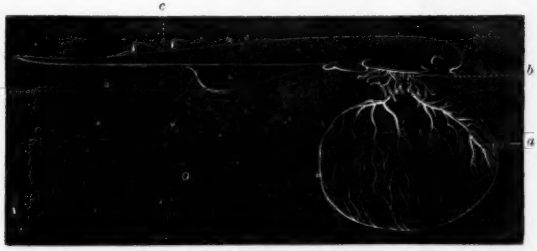
*The singular Surinam Toad whose eggs are developed in cells formed on the back of the parent. — F. W. P.

velopment has been thus far studied. As they grow, they advance on either side of the head in the form of horns (figs. 94 and 95, a'), but by degrees the space between these horns and the side of the head is filled up, and thus the eyes and the persistent portion of the first branchial fissure are pushed to the upper surface, and eventually the pectorals gain the foremost part of the side of the head, at the same time becoming united with the extended facial disks.

The tail, as the whole animal increases in size, becomes relatively very much shorter. In the earlier stages the body is only three sixteenths of the entire length of the embryo, but subsequently it is about one half that length, as will be seen by a comparison of figs. 93, 94, 95, and 96."

"*Branchial Fissures and Gills.* — In nearly all adult Selachians there are five gill-openings in each side; Hexanchus and Heptanchus have respectively six and seven such openings. In addition to these, all of the skates and some of the sharks have a peculiar opening just behind the eyes, or

Fig. 93.



More advanced embryo of Skate, having passed through the Eel and Shark-shaped stages and commencing to assume the characteristic form of the adult. *a*, artery; *b*, facial disk; *c*, dorsal fins; *d*, anal fin.

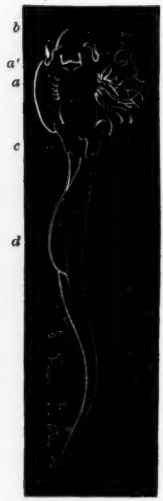
at some point between these and the first branchial fissure, which makes a direct communication, for the most part of a large size, between the top of the head and the pharynx, and to which the terms 'spiracle,' 'event,' 'Spritz-locher,' 'foramina temporalia,' etc., have been applied.

In the youngest embryos of skates here described, we have found the number of gill-openings or branchial fissures seven on each side, all well defined except the last, which is the smallest of the series (figs. 88 and 89). These are all in the same range from before backward, and at this stage the spiracle, as such, is not distinguished from the others. It is characteristic of the early embryos of all Selachians, to have developed, in connection with branchial apparatus, temporary gills which are seen in the form of long and slender filaments projecting from the sides of the neck. They are generally described as coming out through the gill-openings, and as prolongations of the internal gills. Cornalia, who has made a special study of these organs, so describes and figures them. We believe that, in consequence of not having seen embryos sufficiently young, he has been led into an error.

We have found them when first formed, growing from the outer edge of the branchial arch (figs. 89 and 90), and at that time in no way connected with the branchial fissures. In the skate, the first and seventh arch had no fringes at any period, and of the five which had them, the fringes of the foremost ones were the longest, the hindmost being merely short, conical projections. As development advances, the bases of the fringes are gradually covered up, as it seems, by the growth of the portion of each arch in front of them, which is thus projected outward as the body becomes thicker from side to side; the line of attachment of the fringe, which retains its original position, being thus buried between two adjoining arches.

Fig. 94.

Fig. 95.



Dorsal and ventral views of fig. 93. *a*, *a'*, pectoral fins; *b*, facial disk; *c*, ventral fins; *d*, anal fin; *d'*, dorsal fins; *e*, gill fringes.

From the fact that the temporary gills are formed before the permanent ones, and from the outer surface of the arch, it is obvious that they cannot be —as commonly described—prolongations of these last-mentioned breathing organs.

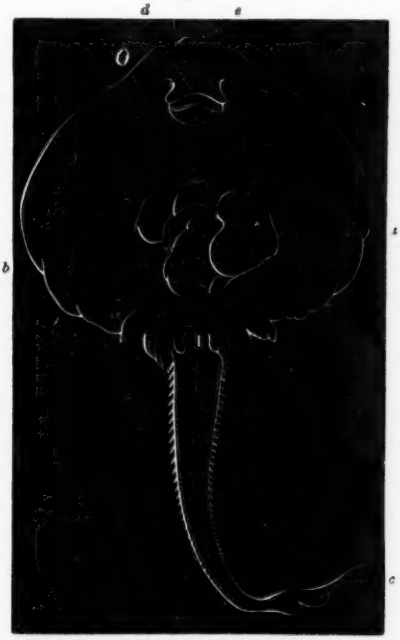
The fringes do not cover the whole border of the arch, but are confined to its central portion, and consist of from six to eight filaments each.

We have made no observations on the formation of the internal gills, and cannot therefore explain the connection which eventually exists between these and the fringes, and which at a later period correspond exactly with the descriptions usually given.

The existence of temporary branchial fringes, and their subsequent absorption, is one of the most remarkable characteristics of Selachians, and one in which they differ from all osseous fishes, unless it be the Lepidosiren. All vertebrates, as embryos, agree in this, that they are in their early stages provided with "branchial fissures" and "arches" or, as they sometimes have been called 'visceral' arches. Gills or gill fringes, either as temporary or permanent structures, are never formed in any scaly reptile, bird, or mammal. Much confusion and misapprehension have arisen from the constant reiteration of the opinion put forth in the early days of embryology, that all vertebrates at one time have a branchial respiration, an error which is repeated by naturalists even at the present day. Among Batrachians some genera, as Menobranchus, Siren, etc., have external

fringes permanently attached to their branchial arches, which are not known to be replaced by, or to coexist with, internal gills. They are their sole organs of respiration, for their lungs are too imperfect and rudimentary to have much physiological importance. In frogs, toads, and salamanders, the external gills are replaced by internal ones, and these in turn by lungs. Thus it will be seen that no Batrachian is permanently provided with internal gills.

Fig. 96.



Newly-hatched Skate: *a*, yelk-sack in the cavity of the abdomen, connecting with the intestine, *b*; *c*, embryonic portion of the tail which disappears in the adult, and corresponds with the portion of the tail behind the dorsal fins in the figures representing still younger stages; *d*, upper lip; *e*, developed facial disk.

Selachians and Batrachians agree in this, that their embryos have in their first stages external fringes growing from the outer surface of the gill arches, and these fringes have the same structure in both. The Selachians still further agree with frogs, toads, and salamanders, in the fact that the outer fringes are absorbed, and are replaced by internal gills. They differ from them, however, in the following particular. Selachians retain their internal gills permanently through life, while, if such exist at all in the Batrachians just mentioned, it is only during the larval stage, and they are soon replaced by lungs. Selachians may therefore be said to pass through stages analogous to the first and second stages of Anourous Batrachians and salamanders.

The other changes which the fissures pass through before the skate acquires its permanent form are as follows. The seventh fissure is closed up at a very early period, about the time that the dorsals are beginning to be formed. While the first arch bends and is drawn forward as already described in connection with the formation of the jaws, it at the same time becomes broader, so as to widen the distance between the mouth and the first fissure, or the second, after the first is partially closed.

The inner part of the first closes up, while the outer remains open (fig. 90, *a*), is somewhat enlarged, and retains its relative position to the eye. It is very soon widely separated from the other fissures by the rapid growth of the intervening parts, and still further by the extension of the pectoral fins forward between this remnant of the first fissure and those behind it, the former being thus thrown to the upper, and the latter to the under surface. The unclosed portion of the first branchial fissure is thus converted into the spiracle.

The transformation thus described is of very great interest when compared with the changes which occur in the corresponding fissures of the air-breathing vertebrates, and enables us to establish an unexpected homology. Reichert, in his most important investigations of the development of the gill arches ('visceral Bogen') of the pig, has shown that in this animal the first fissure is gradually separated from the others by the widening of the second arch, and for a time, even after all the others are closed up, forms a direct opening from the side of the neck into the pharynx. Afterwards it is divided into an outer and inner portion by a membranous septum; the former being the external auditory canal and the latter the Eustachian tube and the cavity of the tympanum. It will thus be seen that the spiracle is not only a true branchial fissure in the first place, but that in the end it is homologous with the Eustachian tube and the outer auditory passage before these are separated from each other by the membrane of the tympanum.

Professor Huxley, in a series of lectures on the Vertebrate Skeleton, in which the homologies and development of it are discussed with great ability, sets forth a somewhat different view with regard to the formation of the external ear, and maintains that the first step is similar to that in the case of the eyes and nose, viz.: an "involution" or a "pushing in" of the integument. Professor Huxley's observations were made on the chick, and he arrives at the same conclusions as Remak, leaving us to infer that the auditory passage and Eustachian tube have no connection with the branchial fissures. We have gone over the same ground in the pig, and have found Reichert's observations, as mentioned above, fully confirmed.

The relation of the spiracle to the branchial fissures is still further shown by the fact that in some species, as in Scyllium and Læmargus, it, like the others, is provided with respiratory fringes. In the skate this is not the case, but in the adult a comb-like fold, resembling, and probably having the functions of, a gill, is found just within the spiracular opening."

For a description of the development of the mouth and nostrils, and some other details which have been omitted in these extended quotations, the reader is referred to Professor Wyman's Memoir.

NOTES ON SOME OF THE RARER BIRDS OF MASSACHUSETTS.

BY J. A. ALLEN.

(Continued from page 585.

BAIRD'S SPARROW. *Centronyx Bairdii* Baird. Mr. C. J. Maynard while collecting Long-spurs and Snow Buntings on the Ipswich sand-hills, December 4th, 1868, had the good fortune to shoot the first specimen* of this species thus far obtained east of the Missouri, so far as known. No other at least is yet on record, and but one other specimen seems to be extant. This is one of Audubon's types collected near the mouth of the Yellowstone, in the summer of 1843, and now in the Museum of the Smithsonian Institution. Mr. Audubon is the only naturalist who has previously met with it. He reports it as common at the locality where he discovered it, where he obtained both males and females and its nest.† But very little is known respecting its migrations or its distribution. Its discovery in Massachusetts was quite unlooked for. Mr. Maynard thinks he saw others, but supposing it to be some other species he made no especial efforts to obtain them. In his notes kindly communicated to me he remarks: "I saw other specimens, and am confident that I detected it the preceding season, 1867. It is probable that it is a regular winter visitor from the north, accompanying the *C. Lapponicus* and *P. nivalis*, for it does not seem probable that it should occur regularly so far from its usual habitat—the distance being some over sixteen hundred miles—and not be found in the intermediate space." As he further observes, his specimen somewhat resembles the Bay-winged Sparrow (*Poœcetes gramineus*), with which inexperienced ornithologists might easily confound it. It is

*Mr. Maynard gives a good figure of this specimen in his book on Taxidermy ("Guide to Naturalists in Collecting and Preserving Objects of Natural History") now publishing.

†Birds of America, Vol. vii, p. 359, pl. 500.

certainly nearer this than the Savannah Sparrow, with which it has been compared. "My specimen," he says, "also differs in size [from Audubon's*]. I give measurements of both for comparison, remarking that mine was measured from the fresh bird, while the other was from the skin."

Locality.	Date.	Length.	Alar ext.	Wing.	Tail.	Bill.	Tarsus.	Sex.
Mouth of Yellowstone.	1843	4.64	——	2.77	2.10	.39	.84	–
Ipswich, Mass., ...	Dec. 4, 1868.	6.30	11.00	3.25	2.60	.40	.95	♂

It differed in color as well as in size from the specimen described by Prof. Baird. The former difference is doubtless due to the different seasons of the year at which they were collected, and the latter to the fact of the Ipswich specimen having a more northern birth-place. That there might be no mistake, the specimen was transmitted to Professor Baird for examination, who kindly compared it with the type in the Smithsonian Institution, and reports that he found them identical.

Savannah Sparrow. *Passerculus savanna* Bon. Rather rare in the interior at all seasons, and, so far as I can learn, only seen there during its migrations. On the coast, however, it is one of the most common sparrows throughout the summer, where great numbers breed. I have seen it from Ipswich southward all along the coast to Nantucket Island. On the islands off the coast it is often the most numerous species of bird. The Song Sparrow, on the contrary, is more numerous in the interior, it being comparatively scarce on the islands and on the coast close to the sea.

Henslow's Sparrow. *Coturniculus Henslowii* Bon. This species must still be considered a rare summer visitor, though it proves to be more common than was supposed a few years since. Specimens are taken in the eastern part of the state nearly every year, where also several of its nests

* See Baird's Birds of North America, p. 441.

have been found. The first nest found in this state was discovered by Mr. E. S. Wheeler, in Berlin, and the fact is recorded in the seventh volume of the Proceedings of the Boston Society of Natural History (page 137). This species was at first wrongly identified as *Peucea Backmanii* Aud (=*P. æstivalis* Baird), and as such stands recorded in the sixth volume of the same Proceedings (p. 21). The mistake was corrected, however, on p. 74 of the same volume, so that *Peucea æstivalis* has never been included nor referred to as a bird of Massachusetts in any of the lists of the birds of the state, or of New England.

In respect to *C. Henslowii*, Mr. Maynard informs me it has been confounded with *C. passerinus* by a number of collectors, and that it seems to be more common at some localities in the state than the latter.

White-crowned Sparrow. *Zonotrichia leucophrys* Sw. Rare in all parts of the state, and thus far not known to breed in Massachusetts, though it may do so among the mountains in the western counties. Though mentioned by Dr. Coues as "usually common, but of somewhat irregular occurrence" in New England,* the score or more of collectors with whom I am acquainted all look upon it as one of our rarest species in Massachusetts. Some have never met with it. More to the westward, however, it is quite common. In Wayne county, New York, I found it as numerous in May, 1867, as the White-throated Sparrows usually are in New England.

White-throated Sparrow. *Zonotrichia albicollis* Bon. A pair of these birds, probably the same pair, has been observed by Mr. R. B. Hildreth at Springfield during the last three summers. Though he has not succeeded in discovering their nest, he this year observed them feeding their scarcely fledged young. He reports that they have become very familiar and readily answer his call. Though breeding nu-

* List of the Birds of New England, l. c. p. 282.

merously in Northern New England, Springfield is considerably south of their customary breeding range.

Sharp-tailed Finch. *Ammodromus caudacutus* Swain. Some half a dozen nests and as many pairs of the birds were obtained the present year, by Mr. H. W. Henshaw in the Charles River marshes in Cambridge. These are the only recent instances known to me of the finding of the nest of this species in Massachusetts. None of the Seaside Finches were observed, though they were formerly known to breed in the Chelsea marshes, and probably do still.

Tree Sparrow. *Spizella monticola* Baird. I mentioned in my Catalogue that a nest of this species was found in this state in 1855 by Mr. E. Samuels, there being a record to that effect in the fifth volume of the Proceedings of the Boston Society of Natural History (p. 213). I have since learned from Mr. E. A. Samuels that this was a case of malidentification, the nest and eggs being really those of the Chipping Sparrow (*Spizella socialis*). Dr. Brewer confirms the latter account, and says he has the nest in his possession.

Lincoln's Sparrow. *Melospiza Lincolnii* Baird. The first record of the occurrence of this species in Massachusetts is given in my Catalogue, at which time I had taken three specimens at Springfield. It has since been taken by Mr. S. Jillson, at Hudson,—one specimen in May, 1867, and another in May, 1868. In 1867 I took it in May in Wayne County, N. Y., when it appeared to be not uncommon, and in Northern Illinois the same year I found it numerous.

Swamp Sparrow. *Melospiza palustris* Baird. In the "Addenda" to Dr. Coues' "List of the Birds of New England" I stated I had never met with this species in the breeding season. I have since learned that it is not at all uncommon at that season at several localities in the eastern part of the state; some years it breeds quite numerously in the Fresh Pond marshes.

Black-throated Bunting. *Euspiza Americana* Bon. Since the publication of my Catalogue, Mr. C. W. Bennett

has taken this species at Holyoke,—a single specimen in May, 1866. Dr. Brewer informs me he has found it breeding at Hingham. The species is still known, however, as only a straggler from the southward.

Cardinal. Red Bird. *Cardinalis Virginianus* Bon. Four specimens of this bird were taken near Springfield in October, 1866. Mr. W. H. Niles observed it at Belchertown the last week of October, 1868, and at Southampton May 5th, 1869. As these form all the recent authentic instances of its occurrence in the state, it can only be regarded as an accidental visitor. It has been questioned whether in the previous instances of its capture here the specimens taken were not birds that had escaped from cages. In all probability they were, however, wild birds.

European House Sparrow. *Passer domestica* Leach. The few pairs turned loose in the Boston Common a few years since seem to be slowly increasing in numbers, and bid fair to be of great service in checking the ravages of several species of caterpillars that now greatly injure the foliage of the shade trees. These interesting birds are now frequently observable both on the Common and in the Public Garden.

European Goldfinch. *Carduelis elegans* Steph. February 28th, 1865, I saw a single male on Quincy street, Cambridge, that had probably escaped from a cage. It was feeding on the seeds of the larch and appeared fully at home. Its notes first drew my attention to it, which, while so much resembling those of our common Yellow Bird, yet differ from them in surpassing in sweetness the pleasant warble of that favorite bird. I doubt not that if a considerable number of European Goldfinches should be introduced into New England the species would soon become acclimated and generally distributed.

Serin Finch. *Serinus meridionalis* Brehm. A specimen of this European species was taken near Springfield in November, several years since. It may have been a cage bird that had escaped.

YELLOW-HEADED BLACKBIRD. *Xanthocephalus icterocephalus* Baird. The wings, tail and feet, of a specimen of this species taken in Watertown, in October, 1869, were shown me a few weeks since by Mr. C. J. Maynard. Although the whole bird was unfortunately not preserved, its identity could be readily determined. This is the first known instance of the occurrence of this species in New England, but Mr. Cassin* states that several have to his knowledge been taken near Philadelphia. Its usual eastern range, as ornithologists well know, is the vicinity of Chicago, it being essentially a prairie species.

BOAT-TAILED GRACKLE. *Quiscalus major* Vieill. I now seriously question the occurrence of this southern species in Massachusetts, or anywhere in New England, as even an accidental visitor. I gave it as such in my Catalogue, but a reëxamination of the evidence has led me to my present opinion. I think the cases cited by Peabody† and Linsley‡ (under *Q. baritus*) as well as that of Mr. Samuels, refer only to the common Crow Blackbird or Purple Grackle.

SPRUCE PARTRIDGE. *Canace Canadensis* Bon. The occurrence of this northern species in the hemlock woods of Gloucester in 1851 was recorded by Mr. F. W. Putnam.‖ This instance is cited in my own Catalogue, and by Dr. Coues in his "List of the Birds of New England." A second instance is to be now added, as I have learned from Mr. S. C. Martin that a bird of this species was shot in November, a few years since, in Roxbury. These two instances seem to be all thus far known, and only give it a place on our list as a very rare, accidental visitor. I have, however, recently learned from Mr. Wm. Brewster, of its capture near Portland, Maine, in the autumn of 1868,—a locality much south of its usual range.

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* Proc. Phila. Acad. Nat. Sci., Vol. xviii, p. 11, 1866.
† Rep. on Orn. Mass., p. 285.
‡ Amer. Journ. Sci. and Arts, Vol. xliv, p. 260.
‖ Catalogue "Birds of Essex Co.," Proc'd's Essex Inst., Vol. i, p. 224.

The Ptarmigan (*Lagopus albus*), captured at Manchester in May, 1859,* is supposed, Dr. Coues states, "to have been brought alive from Labrador or Newfoundland, and escaped."†

Great White Heron. *Herodias egretta* Gray. To the previously recorded instances of the capture of this beautiful southern Egret in this state may be added the following. Two immature specimens were taken near Hudson by Mr. S. Jillson in 1867, and several others seen there. A fully plumaged male was also taken in Ashland in May several years since by Mr. A. L. Babcock, and another near Lynn, by Mr. N. Vickary. New Jersey seems to be the most northern point on the Atlantic coast where these birds breed, or at which they can be considered as regular visitors, yet this species, as well as the Snowy Heron (*Garzetta candidissima*), have recently been captured in Nova Scotia.‡

Little Blue Heron. *Florida cærulea* Baird. In addition to the previously recorded instances of its occurrence in Massachusetts, Mr. Maynard informs me he has recently seen it on one or two occasions in autumn.

Yellow-crowned Night Heron. *Nycherodius violaceus* Reich. Mr. N. Vickary, of Lynn, the well known taxidermist, informs me that in October, 1862, he shot a fine specimen of this bird in Lynn. Though occurring occasionally as far north along the coast as New York, I have learned of no other instance of its capture in New England.

Glossy Ibis. *Ibis Ordii* Bon. In addition to those previously recorded as having been captured in Massachusetts, a specimen was taken in Nantucket, September, 1869. It was also taken, as I learn from Mr. N. Vickary, in New Hampshire, in October, 1858, by Dr. Palmer.

Wilson's Plover. *Ochthodromus Wilsonius* Reich. The usual northern limit reached by this bird seems to be the

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*F. W. Putnam, Proc. Essex Inst., Vol. ii, p. 378.
†Ibid., Vol v, p. 289.
‡J. Matthew Jones, Trans. Nova Scotia Inst. Nat. Sci., Vol. ii, pt. 2, p. 72 (1868).

coast of New Jersey, where it is said to breed.* In my Catalogue I inserted it as a bird of this state on the authority of Dr. Brewer, who, according to Mr. Peabody, found them abundant at Nahant in August, 1838. But Dr. Brewer wrote me under date of May 8th, 1869, that "Wilson's Plover is *not* a Massachusetts bird, so far as I know." Dr. Wood informs me that "Wilson's Plover is abundant in August on Long Island," and Mr. Linsley has recorded it from Stratford, Connecticut. It hence seems unquestionable that they sometimes occur in Southern New England, and it would not be strange if they should occasionally reach the coast of Massachusetts.†

Black-necked Stilt. *Himantopus nigricollis* Vieill. Mr. G. A. Boardman informs me that he once saw two specimens of this species in Boston Market that were killed in this state. I have also learned from Mr. Maynard that it is well known to the gunners of Ipswich, who occasionally meet with it, and by whom it is ironically named "Humility." It appears to be, however, one of the rarest of our visitors, it being properly a southern and south-western species.

Sanderling. *Calidris arenaria* Illiger. A few specimens of this species and of the Semipalmated Sandpiper (*Ereunetes pusillus* Cass.), and the Solitary Sandpiper (*Rhyacophilus solitarius* Baird), were taken by Mr. Maynard and myself at Ipswich in June, 1868. The last mentioned may have been breeding, as the Massachusetts coast is within its usual breeding range, but the others appeared to be only stragglers that were not breeding, all, apparently, being immature birds. The first of these is well known to breed on the coast of Maine, where Prof. Verrill gives it as abundant in summer. In some notes hastily penned for Dr. Coues' "Addenda" to his "List of the Birds of New England," written from memory (at the time of writing them I was on

* Dr. C. C. Abbott, Geology of New Jersey, Appendix.

† Compare with this Dr. Coues' remarks on this species in his "List of the Birds of New England," l. c., p. 291.

a journey and my notes were inaccessible), I state that *Actodromas Bonapartei* was among the birds seen by us in summer on the Massachusetts coast. This I think is an error of memory, as I do not find it recorded in my note book, and no specimens of it were taken. *Arquatella maritima* is also there mentioned as having been *seen;* though this is probable, I should add that it does not rest on positive evidence, as none were taken.

Stilt Sandpiper. *Micropalama himantopus* Baird. As this southern species has been twice taken recently at Rye Beach, New Hampshire, by Mr. William Brewster, the question as to whether it should be included among the birds of New England is now settled. As it must have passed through Massachusetts, it is properly to be included in our list, though not yet recorded as actually taken in this state.

Yellow Rail. *Porzana Novæboracensis* Cass. Taken by Mr. C. J. Maynard, September 8th, 1868, in a dry field in Newton.

Common Gallinule. *Gallinula galeata* Bon. I learn from Mr. Ruthford Deane of Cambridge that he shot a young bird of this species in Fresh Pond on the 3d of September, 1868, and saw two others in the latter part of the same month. The 9th of October of the same year he informs me his friend William Brewster shot one which he obtained, and wounded another, at the same locality. Also that the latter observer saw an old bird there on the 3d of June, which Mr. Deane believes to have been the parent of these young. As this species regularly breeds in New Jersey, it is not improbable that straggling pairs may now and then rear their young in Massachusetts, but this is much beyond its usual breeding range.

Canvas-backed Duck. *Aythya vallisneria* Bonap. It is stated in my Catalogue that this species was taken near Springfield by Dr. Wood. This proves to be an error, as Dr. Wood has since informed me he never knew it taken nearer that locality than ten miles above the mouth of the

Connecticut. So far as I have been able to learn by careful inquiry, this species is much less common in New England than several authors represent. It seems to be but an accidental or very rare visitor.

American White Pelican. *Pelecanus erythrorhynchus* Gmelin. I learn from Mr. S. C. Martin that a flock of thirteen individuals visited Nantucket Island during a heavy storm a few years since. After being repeatedly fired at one of them was finally killed, near Brant Point light-house. Mr. C. J. Maynard also informs me that several were seen at Ipswich at about the same time. The only other recent instance of the capture of this species in New England seems to be that at Calais, Maine, given by Mr. G. A. Boardman.* It seems to be entirely accidental here now, although formerly, according to early writers, of not unfrequent occurrence. It still ranges, however, over the greater part of the continent.

Herring Gull. *Larus argentatus* Brünn. Although large numbers of this species spend the summer along the Massachusetts coast, I have not been able to find any breeding here. Those seen in summer are all immature birds, generally in brown plumage. Although they once unquestionably bred on our coast, none now appear to rear their young nearer than the northern part of the coast of Maine. Hence the occurrence of large numbers of immature birds in summer two hundred miles south of the nearest breeding grounds of the species is a fact of considerable interest.

Some years since Dr. Elliott Coues separated the American Herring Gull from the European, under the name of *Larus Smithsonianus*, he supposing it to differ in certain points of coloration from the European bird.† Unfortunately, these differences do not prove constant, specimens identical in every particular with the typical European *L. argentatus* of Coues occurring not unfrequently on the New

* Proc. Bost. Soc. Nat. Hist., Vol. ix, p. 130.

† Revision of the Gulls of North America, etc., Proc. P. A. N. S., June, 1862, p. 296.

England coast. As I have already called attention to this fact* I will only add that during last winter additional specimens of this character were obtained by me in Cambridge.

Laughing Gull. *Chræcocephalus atricilla* Lawr. This bird now breeds on the Massachusetts coast very sparingly, it having been nearly extirpated by the incessant persecution it suffers from "eggers" during the breeding season. A few pairs were observed last year on Muskeget Island, by Mr. Maynard and myself, and a few of its eggs obtained, about July 1st. As they had previously been repeatedly robbed, "eggers" almost constantly haunting the island, they were extremely shy. Another small colony of this species, I have learned from Mr. L. L. Thaxter, breed on the islands near Tennant's Harbor, Maine.

In my Catalogue I by some mistake gave this bird as occurring in *winter*. Though said by Mr. Boardman to be resident in the vicinity of Calais, Maine, I have as yet been unable to learn of its occurrence in this state except in summer. My earlier impression that the species was resident in Massachusetts I have since found was wrongly founded.

Common Tern. *Sterna hirundo* Linn. This interesting bird must soon be numbered among the species which persecution has driven from the state during the breeding season, unless some effective mode of protecting it during the breeding season is soon adopted. At present it is only found at a few localities, chiefly on Muskeget and the neighboring islets; a few only breed at different points along Cape Cod and at Ipswich. Almost everywhere they are more or less persecuted, and at Muskeget this and the other species of Terns that breed there are so systematically robbed of their eggs that if they succeed in rearing any young at all it is only after having been several times deprived of their eggs. Muskeget is a small, barren, sandy, crescent-shaped island, about two miles in length, with, in its wider part, a breadth

* Memoirs Bost. Soc. Nat. Hist., Vol. i, p. 520.

of about half a mile. Only thinly clothed with beach grass, it is naturally well suited to the breeding habits of the several species of Terns that regularly resort to it to breed. Though uninhabited by man and quite distant from large towns, the birds are far from secure there. Besides the daily visits of small egging parties during the proper season from Nantucket and other near points, excursions are made by large parties from distant places to the island for the express purpose of participating in the novelty of an egg hunt, with sad results to the birds, as above stated. This is certainly a matter that the "Society for the Prevention of Cruelty to Animals" should look after.

Arctic Tern. *Sterna macroura* Naum. In company with the preceding are found a certain proportion of these birds. Last year Mr. Maynard and myself found them breeding apart from the others on the island of Muskeget. We also found them at Ipswich, as Mr. Maynard has also done the present year. In voice and habits, however, the two seem not to differ in the slightest, nor in general size. In color they only differ as young birds often do from older ones of the same species, the *S. macroura* corresponding to the mature form and the *S. hirundo* to the younger. The tarsi and the bill in *S. macroura* seemed to be generally the shorter, but not always. In color *S. macroura* was always the brighter, without the black tip of the bill seen in *S. hirundo*; the black on the head is generally more intense and better defined; the sooty wash beneath is much deeper, and the white of the rump purer. The tarsus was not only shorter but had a roughened appearance not seen in the other, they differing in the latter respect much as young birds in this and allied families frequently do from those perfectly mature. On the whole there seemed to be good reasons for believing them to be simply different ages of the same species. The young of *S. macroura* being then unknown, it was evident that the discovery of them would afford decisive evidence on the point in question. Fortunately this

year Mr. Maynard succeeded in obtaining the young of *S. macroura* at Ipswich, when they were just able to leave the nest. A comparison of these with the young of *S. hirundo* of corresponding age, or even with mature *S. hirundo*, leaves no question as to their distinctness. The differences between the young of the two are as great as between the adult. In these nestlings of *S. macroura* the color of the rump is as different from that of the back as it is in the adult, the plumbeous bluish mantle not being continued to the tail as in *S. hirundo*.

The distinctive differences then between them may be stated thus:

S. macroura has the under parts strongly tinged with plumbeous, with the throat and under tail coverts abruptly white, while in *S. hirundo* the under parts are faintly washed with plumbeous which fades gradually into white on the throat and under tail coverts. *S. macroura* has the shorter tarsi, and the shorter, smaller and more delicately shaped bill; in color the bill of the latter is uniformly carmine, not coral red with a black tip, as in the other, and the tarsi and feet deep vermilion, almost lake (not light vermilion as in *S. hirundo*), and roughened. The rump is abruptly white at all ages, while in *S. hirundo* it is dilute plumbeous, shading gradually into the color of the back. In size and general proportions there are no essential differences between them.

So long as the young of *S. macroura* was unknown, it seemed that the differences in color between the young of *S. hirundo* and the adult of that species, if carried a little further, would result in a form, so far as color is concerned, exactly like *S. macroura*.*

Roseate Tern. *Sterna paradisea* Brünn. Occurs plentifully on Muskeget Island during the breeding season. Was also taken by Mr. Maynard and myself at Ipswich in June,

*For an excellent revision of the Terns of North America, see Dr. Elliott Coues' paper on this subject in the Proceedings of the Philadelphia Academy of Natural Sciences, 1862, p. 535.

1868. Heretofore generally considered rare in this state, which appears to be its northern limit.

Sandwich Tern. *Sterna cantiaca* Gmelin. (*Sterna acuflavida* Cabot.) Mr. Nathaniel Vickary, of Lynn, has a specimen of this species in his collection, which he shot at Chatham, in August, 1865. The usual northward range of this southern species does not extend beyond South Carolina, and is now for the first time reported as captured either in this state or in New England.

Short-tailed Tern. *Hydrochelidon fissipes* Gray. Occasional, chiefly after the breeding season. Mr. C. J. Maynard has taken it at Ipswich, and probably it occurs all along the coast, though its existence here has been questioned.

Sooty Tern. *Haliplana fuliginosa* Wagl. (*Sterna fuliginosa* Gm.) This species was given in my list as a rare summer visitor, on the authority of Mr. E. A. Samuels, who —he having found two young birds he referred to this species—informed me that it bred on Muskeget Island. As it is a southern species, and is only occasional on the coast of New Jersey, which is north of its breeding range, it is somewhat doubtful whether it is entitled to a place in a list of the birds of Massachusetts. Respecting this species Dr. Brewer has written me as follows: "It does not and never did breed on Muskeget, nor do I believe it ever comes here." Since the equally southern Sandwich Tern has been taken here, the probability of this being also an accidental visitor is increased.

Great Auk. *Alca impennis* Linn. This species has recently been made known as a former inhabitant of Massachusetts. Professor Wyman first discovered its remains in New England at Mount Desert, in the Indian shell-heaps.* Mr. F. W. Putnam reports that a humerus of this bird was found in August, 1868, in the shell-heaps of Ipswich, by Professor Baird.† Mr. Maynard and myself found frag-

* American Naturalist, Vol. i, p. 578.

† Coues' "Birds of New England," Proc. Essex Inst., Vol. v, p. 310, foot note.

ments of several different bones of this bird in June of the same year at the latter locality, where also Mr. Maynard had obtained them in previous years.

It appears, from information received too late to enable me to insert them in their proper places, that the following species should also be added to those already recorded from Massachusetts:

Swallow-tailed Hawk. *Nauclerus furcatus* Vigors. From Mr. Bennett I have received a description of a hawk seen near Whately, not long since, that was unquestionably of this species; but, so far as I am aware, it has not yet been taken in Massachusetts. Although a southern species, it is rather common in the interior as far north as Iowa, and stragglers have been taken along the Atlantic coast as far north as New York. It can only occur in New England, however, as an extremely rare visitor.

A South American Humming Bird, *Argytria maculata* Cab. and Heine, was taken in Cambridge in August, 1865, by Mr. Wm. Brewster. It seems almost incredible that so small a bird should wander so far from its usual haunts, since its real habitat is the northern countries of South America; yet after carefully investigating the history of this specimen, it seems to me there is no reason to doubt its capture in this state. It is possible, of course, that it may have been brought here in a cage and have escaped, but that such was the case does not appear to be at all probable.

Gray King Bird. *Tyrannus Dominicencis* Rich. A specimen of this species, now in Mr. Vickary's collection, was shot in Lynn, early in October, 1869, by Mr. Charles I. Goodale. Although essentially a West Indian species, it is not uncommon in Florida, but only occasionally ranges so far north as Charleston, South Carolina. It hence forms one of the most remarkable additions to the fauna of the state yet recorded. The specimen was evidently a young bird, or a bird of the year.

The following facts also came to hand too late to be inserted in their proper connection:

Black Vulture. *Cathartes atratus* Less. Mr. S. Jillson informs me that a specimen of this species was killed in Hudson a short time since, and that several others were seen there which no one cared to shoot. Mr. G. A. Boardman has also recently taken it near Calais, Maine.* Though rather more southern in its distribution than its near relative the Turkey Buzzard (*C. aura*), it seems to be much more frequently met with in New England, and has been taken as far north as Nova Scotia.

Barn Owl. *Strix pratincola* Bon. A specimen of this species, Mr. Vickary informs me, was taken in Lynn six years since, by Mr. James Teal, and is still in a private collection in that town. This forms the second specimen of this species thus far known to have been taken in Massachusetts.

Tengmalm's Owl. *Nyctale Tengmalmii* Bon. Mr. Vickary has a specimen of this rare winter visitor that he informs me was shot in Lynn, in 1863, by Mr. J. Southwick. I have also seen two other specimens of this bird that have been recently killed in this state.

This is the species referred to in my Catalogue as Richardson's Owl (*Nyctale Richardsonii* Bon.), which is the name of late generally given to it by American authors. It does not, however, upon comparison, appear to be distinct from the so-called Tengmalm's Owl of Europe, with which, previous to 1838, it was by all writers considered to be identical.

From information received since the first part of this paper went to press, several species whose occurrence in Massachusetts was unknown to the writer at that time (two of them having been for the first time captured here since that part of the paper was written) have been added to the

* See American Naturalist, Vol. iii, p. 498, November, 1869.

Massachusetts fauna, so that a revision of a portion of that part is already necessary.* The whole number of species is now three hundred and eight, or—excluding the House Sparrow (*Passer domestica*), which has been introduced by man, the Goldfinch (*Carduelis elegans*), the Serin Finch (*Serinus meridionalis*), and the South American Humming Bird, which may also have been (but probably were not) similarly introduced—three hundred and five, instead of three hundred, as there stated, or two hundred and ninety-six, as given in my Catalogue. Three of the species recorded in the Catalogue being now no longer counted, the whole number of species of birds added to the fauna of the state since 1864 is sixteen; eleven, and probably fifteen, of which can unquestionably be legitimately counted.

In this connection it may be asked, in view of the numerous recent additions to the bird fauna of this state: Are not certain species that were formerly regarded as scarce here now increasing in numbers? and is it not probable that some of the species recently detected have but recently made their first appearance here?

It is probable that a few species have recently increased and still are increasing in numbers; but it seems more probable that in most cases this apparent increase is more the result of the much greater number of observers now in the field than formerly, and the consequently much greater amount of attention recently given to the ornithology of our state. Doubtless other species will soon be detected here.

The occurrence of several species in Massachusetts whose

*The following corrections should be made in the first two parts of this article:—Page 512, last line, for *seven* read *twelve*. Page 512, add to the second foot note, *Buteo Cooperi, Tyrannus Dominicensis, Xanthocephalus icterocephalus, Nycherodius violaceus, Sterna cantiaca*. Page 513, change the sentence beginning in the ninth line to read as follows: Others now added, especially the California Hawk (*Buteo Cooperi*), Baird's Finch (*Centronyx Bairdii*), and the Gray King Bird (*Tyrannus Dominicensis*), are similar and equally remarkable cases of western and southern species straggling far beyond their usual range. Page 513, 19th line, for *specimens* read *species*. Page 513, 25th line, for *three hundred* read *three hundred and fifteen*. Page 516, 1st line, for 1862 read 1861. Page 518, 12th line, for *characteristic* read *well-marked*. Page 582, 19th line, for *frontalis* read *Californicus*. Page 583, 16th line, for *epilipes* read *exilipes*. Page 584, 2d line from bottom, for *have* read *had*. Page 585, 8th line, dele *of*.

usual range does not extend much to the eastward of the Mississippi River, and of two not usually found east of the Rocky Mountains, and of others that rarely occur north of Florida, shows the possibility of a species becoming widely diffused over districts favorable to its existence by occasional migrations.

OUR COMMON FRESH-WATER SHELLS.

BY EDWARD S. MORSE.

Among the most common of our fresh-water mollusks are the air-breathing water snails. Muddy lakes, ponds, streams and marshes, being their favorite abodes, and even ditches sometimes swarming with them. It would be difficult to find a body of fresh-water that did not contain certain representatives of this class.

Their shells are quite uniform in texture and color, containing but little lime, and for this reason are quite light, and even in some species slightly elastic. They are quite hardy in confinement, and a few specimens secured in early spring time will afford many pleasant hours of amusement to those interested in watching their habits. They have to come often to the surface of the water to breathe, and it is curious to watch them during this operation. The snail with its broad disk slowly sweeping along the glass, feeding at the same time by lapping up whatever particles of food it may meet with. As it nears the surface the shell is inclined in such a way that the aperture is brought almost out of water, and then a funnel-like process is opened in such a way that the air enters the respiratory cavity, while the water seems to be repelled by the edge of the funnel.

During the spring time the eggs are laid and attached to some substance by a transparent mucous. If laid upon the glass walls of an aquarium, or the sides of a glass dish,

the complete development of the egg into a little snail, may be easily watched with a common magnifier. When nothing more than a cluster of cells may be defined within the egg, this mass is seen to slowly and continually revolve within. Soon two little eyes make their appearance, and by successive stages the shell is formed, and with a high magnifier the little one may be seen eating its way through the egg-shell and mucous which surrounds it.

These snails have the power of crawling or floating along the surface of the water, the creeping disk being just level with the surface and the shell hanging beneath. When they wish to sink, a portion of the air contained in the lung cavity is expelled, and a slight clicking sound is heard accompanying this movement. They are mostly vegetable feeders, and seem to live on the ooze and slime that cover the stones and aquatic plants of their abode.

There is one little species that seems more like a land snail in its habits, from the fact that it can live a long time without immersion in water. It is generally found in little pools, where the water stands only a portion of the year. During the dry season it hibernates like the land snails by plugging up the aperture of the shell with a thin partition of a viscid secretion of the animal, and in this condition will survive the droughts of summer.

A simple and serviceable collecting apparatus can be made from a tin dipper fastened to a pole six or eight feet in length. The bottom of the dipper should be made of wire netting. With this one can scoop along the bottom of ditches and ponds, and will be rewarded by finding many a curious shell. And if he is at all interested in insects he will turn up some singular looking monsters in miniature, that will turn out to be the larval state of dragon flies or other well known forms. Even without the dipper the collector may find many species by examining the bits of bark and stone and the stems of aquatic plants that he may pull up from the pond. The under side of lily-pads also proves a resting

place for certain species. With the results of a day's collecting before him he will probably find the following genera of air-breathing water snails represented.

Lymnæa, in which the aperture of the shell is on the right side, when the shell is held with the apex upward, and the aperture facing you, the tentacles being broad and triangular.

Physa, in which the aperture is always on the left side, if the shell is held in the position just described, and the tentacles slender.

Planorbis, in which the shell is always coiled in a plane so that there is no elevated spire.

Ancylus, in which the shell differs very widely from all the rest in having no twisted spire, but in having the shape of an oval flattened bowl.

There is a common marine shell called *limpet* that the shell of *Ancylus* greatly resembles in form, though the animals are entirely unlike.

Lymnæa.

Physa.

Ancylus

Planorbis.

We here give figures of these four characteristic forms, side by side, and these are represented in North America by about one hundred and twenty species, according to Binney.

In the plate we have figured some of the prominent species of *Lymnæa* and *Physa*, the cuts having been loaned us by the Smithsonian Institution, whose publications in this department have been of great value to the student in quest of these animals.

In the explanation of plate the distribution of the species represented is given. We may add that the species of these genera are very perplexing to define, and will require

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Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

Fig. 5.

Fig. 6.

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 10.

Fig. 11.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 15.

Fig. 16.

Fig. 17.

Fig. 18.

Fig. 19.

Fig. 20.

Fig. 21.

Fig. 22.

Fig. 23.

Fig. 24.

Fig. 25.

Fig. 26.

Fig. 27.

MORSE ON FRESH-WATER SHELLS.

much patient labor to characterize those that are truly species and those that are varieties only.

EXPLANATION OF PLATE 11.

Fig. 1. *Lymnæa megasoma* Say. Lake Champlain to Michigan.
" 2. " *appressa* Say. Northern States to Pacific.
" 3. " *reflexa* Say. Northern States.
" 4. " *decollata* Mighels. Maine, Connecticut.
" 5. " *proxima* Lea. California.
" 6. " *gracilis* Jay. Lake Champlain to Michigan.
Figs. 7, 8, 9, 10, 11, 12. *Lymnæa elodes* Say. Northern United States.
Fig. 13. *Lymnæa desidiosa* Say. New England to Kansas.
Figs. 14, 15, 16, 17, 18, 19. *Lymnæa columella* Say. New England, Lake Superior, Georgia.
Fig. 20. *Physa ampullacea* Gould. Oregon.
" 21. " *Virginea* Gould. California.
" 22. " *Lordii* Baird. British Columbia.
" 23. " *gyrina* Say. Northern United States; figured from original specimen.
Fig. 24. *Physa elongata* Say. Northern United States.
" 25. " *heterostropha* Say. Throughout United States.
" 26. " " Animal expanded.
" 27. " *humerosa* Gould. Colorado Desert.

WHAT IS BATHYBIUS?

BY PROFESSOR W. C. WILLIAMSON, F.R.S.

During each successive year the Protozoa prove to be of increasing importance to the physiologist. In no other class of matured animals can the protoplasm, of which we have recently heard so much, be studied to such advantage. Constituting the lowest known manifestation of both animal and vegetable life, it seems to bring us very near to the boundary between the organic and the inorganic worlds. It exhibits the simplest phenomena of life under the least complex of conditions; hence it has recently been appealed to by one of the most philosophical of living zoologist as capable of

throwing light upon the most recondite of biological problems. Without accepting all, or even the chief of the conclusions at which Professor Huxley has arrived from his study of protoplasm, he must be deemed right in the importance which he assigns to it. Whether seen as the gelatinous sarcode of the Protozoa, occupying the base of the animal kingdom, or as the yolk-material out of which the embryo of the highest vertebrate is formed; whether we observe its plastic mass in the primordial germ of a Protococcus or of a Volvox, or as it appears in the leaf-bud of an oak, it everywhere brings before us the first stage in acts of organization in which it is the chief, if not the only actor. Nevertheless, I am unable to see that our study of protoplasm has brought us nearer than before to a knowledge of the origin of that mysterious force which converts inorganic into organized material. There yet remains to be bridged over that unfathomed gulf which separates death from life—the most complex effects of inorganic forces from the simplest of vital phenomena. We can trace the action and development of protoplasm through successive generations of organisms; but, like the spot where the rainbow touches the ground, its mysterious origin recedes as we advance, and a weary chase leaves us no nearer our object than when we commenced its pursuit. We increase our information respecting the conditions of its existence, but not of its origin; and I believe that from the nature of the problem this ignorance will continue.

We are asked, wherein does the so-called vital force differ from other physical forces? Oxygen and hydrogen combine to form water; if you admit vitality, why not require a principle of æquosity to explain this combination and its resultant phenomena? "What better philosophical status," asks Professor Huxley, "has vitality than æquosity?" I reply, we require the admission of no new force to explain the combination of gases in the formation of water. The phenomena occur in accordance with known laws of affinity.

The synthetical experiment is but one of a vast series of similar experiments, in each of which we can combine separate elements with absolute certainty that the resultants will be identical with, and fulfil all the functions of, the same products when formed in nature's laboratory. But the case is different when we turn to living organisms. We may know the proportions of oxygen, hydrogen, carbon, and nitrogen, existing in any form of protoplasm, and we may even succeed in forcing those elements into an artificial combination having the same proportions, but in no single instance have we been able to endow such a combination with the powers of life. The resultant is not protoplasm. It does not live. It performs none of the vital functions. "Certain conditions" are wanting, and, so far as experiment has hitherto gone, the laboratory has proved unable to supply those conditions. Some "force" is required which is not under the control of the ablest physicist, and which differs in kind as well as in degree from those with whose operations he is familiar. We infer this, because all the functions of the resultant of nature's organic synthesis are different from those of all artificial products. It is this lacking force which we indicate under the name of vital; and so long as experimental philosophers fail to make their artificial combinations do what it does, I claim to be as philosophical, and to be acting in as truly a scientific spirit, when I recognize its existence as when I speak of a magnetic force or of a force of gravitation.

Professor Huxley asks, "What justification is there, then, for the assumption of the existence in the living matter of a something which has no representative or correlation in the not living matter which gave rise to it?" Surely the question, thus put, involves a fallacy. Professor Huxley admits that to produce the results referred to the introduction of a new element is needed. The not living matter requires the aid and instrumentality of matter that is living, and it is precisely this necessity which leads me to conclude that the

living matter *does* contain something wanting to the "not living matter."

The living organism increases, multiplies, and reproduces itself through a power that is inherent, whereas a crystal can only do so through powers external to itself; whatever it may be, the vital power is always derived; no *known* combination of inorganic elements or dead forces could have created it. Except in a few obscure cases, too ill-understood to be made the basis of a grave argument, protoplasm can always be traced, directly or indirectly, to some preëxisting form of protoplasm. We nowhere discover any power which, without the intervention of some already living agent, can convert inorganic matter into living matter. If we could even trace back the history of protoplasm, until we reached one of Mr. Darwin's primæval germs, our philosophy would still leave the first of these living azotized combinations unaccounted for. Since, then, scientific experience affords no proof that life is nothing more than a function of material combinations, acted upon by physical forces, we are justified in the recognition of a vital principle, emanating primarily from a living Creator, but which, once created, appears capable of self-perpetuation to the end of time.

If, having recognized the importance of the study of protoplasm amongst the lower animals, we commence its pursuit, we soon discover the difficulties which surround it, especially when we discover the apparent inadequacy of the causes to the effects produced. We see a granular jelly evolving endlessly varied forms of grace and beauty; at one time using silica as its raw material, at another carbonate of lime. Here it glues together grains of sand, there it develops a new sand-like compound, the very nature of which has yet to be discovered. In one form it produces the horny network of a sponge — in another the ethereal tracery of an Euplectella. The colors of its products are almost as varied as their material forms. We seek the cause of all this rich diversity — but seek in vain. We see the almost

motionless granular jelly investing the objects of beauty which it has constructed, but it affords us no indication of the secret of its wondrous power.

We hail every new fact tending to throw light upon a history which is as obscure as it is marvellous. Hence the importance attached to Professor Huxley's discovery of the vast masses of submarine protoplasm, to which he has given the name of *Bathybius*. When, in 1857, Capt. Dayman, of H.M.S. Cyclops, returned from his exploration of the bed of the Atlantic, some of his specimens of "soundings" were placed in the hands of Professor Huxley for examination. The explorers had already noticed the singular stickiness of the mud brought up by the lead, and Professor Huxley soon found that this viscid condition arose from the diffusion through it of abundance of sarcode or protoplasm of a protozoic nature. The mud, like much of what constitutes the bed of the Atlantic, consisted of chiefly accumulated shells of *Globigerina bulloides* — themselves the skeletons of a protozoic sarcode. The Bathybius occurred in minute patches of gelatinous protoplasm, usually of irregular shape, but occasionally assuming roundish forms. It consisted of a transparent jelly containing innumerable, very minute, granules, many of which Professor Huxley found to be equally soluble in dilute acetic acid and in strong solutions of the caustic alkalies; but, in addition, there occurred some remarkable bodies to which great interest is attached. In the first instance Professor Huxley noticed, adherent to the protoplasm, and occasionally embedded in it, numerous minute rounded bodies, soluble in acids, and to which he gave the name of *Coccoliths*. Still later, in addition to these Coccoliths, Dr. Wallich discovered, associated with the Bathybius, some larger spherical bodies of more complex organizations which he designated *Coccospheres*. Yet more recently Professor Huxley has reëxamined his specimens under higher powers, and found his Coccoliths were of two classes — to which he now gives the respective names of *Discolithus* and *Cyatho-*

lithus. The Discolithi he describes as "oval discoidal bodies, with a thick strongly refracting rim, and a thinner central portion, the greater part of which is occupied by a slightly opaque, as it were, cloud-patch. The contour of this patch corresponds with that of the inner edge of the rim, from which it is separated by a transparent zone. In general the Discoliths are slightly convex on one side, slighty concave on the other, and the rim is raised into a prominent ridge on the more convex side."* These objects usually range from $\frac{1}{}$ to $\frac{1}{5000}$ of an inch in their longest diameter.

The Cyatholiths are like minute shirt-studs. They are stated to have "an oval contour, convex upon one face, and flat or concave upon the other. Left to themselves, they lie upon one or other of these faces, and in that aspect appear to be composed of two concentric zones surrounding a central corpuscule." "A lateral view of any of these bodies shows that it is by no means the concentrically laminated concretion it at first appears to be, but that it has a very singular and, so far as I know, unique structure. Supposing it to rest upon its lower surface, it consists of a lower plate, shaped like a deep saucer or watchglass; of an upper plate, which is sometimes flat, sometimes more or less watchglass-shaped; of the oval, thick-walled, flattened corpuscule, which connects the centres of these two plates; and of an intermediate substance, which is closely connected with the under surface of the upper plate, or more or less fills up the interval between the two plates, and often has a coarsely granular margin. The upper plate always has a less diameter than the lower, and is not wider than the intermediate substance.†" These Cyatholithi are further stated to vary in size from $\frac{1}{6000}$ to $\frac{1}{8000}$ of an inch in diameter. The Coccospheres are described by the same distinguished observer as

* On some Organisms from great Depths in the North Atlantic Ocean, *Quarterly Journal of Microscopical Science*, Oct., 1868, p. 206.

† Ibid. p. 207.

"of two types — the one compact and the other loose in texture. The largest of the former type which I have met with measured about $\frac{1}{1300}$ of an inch in diameter. They are hollow, irregularly flattened spheroids, with a thick transparent wall, which sometimes appears laminated. In this wall a number of oval bodies, very much like the 'corpuscules' of the Cyatholiths, are set, and each of these answers to one of the flattened facets of the spheroidal wall. The corpuscules, which are about $\frac{1}{4500}$ of an inch long, are placed at tolerably equal distances, and each is surrounded by a contour-line of corresponding form." "Coccospheres of the compact type of $\frac{1}{1700}$ to $\frac{1}{2000}$ of an inch in diameter occur under two forms, being sometimes mere reductions of that just described, while, in other cases, the corpuscules are round, and not more than half to a third as big, though their number does not seem to be greater. In still smaller Coccospheres, the corpuscules and the contour-lines become less distinct and more minute, until, in the smallest which I have observed, and which is only $\frac{1}{4500}$ of an inch in diameter, they are hardly visible."

"The Coccospheres of the loose type of structure run from the same minuteness up to nearly double the size of the largest of the compact type, viz., $\frac{1}{760}$ of an inch in diameter. The largest (of which I have seen only one specimen) is obviously made up of bodies resembling Cyatholiths of the largest size in all particulars except the absence of the granular zone, of which there is no trace. I could not clearly ascertain how they were held together, but a slight pressure suffices

Fig. 101.*

* Fig. 101 is a "sketch of a mature eight-chambered Textularian shell, each segment of which is studded with Coccoliths. The specimen referred to was obtained along with numerous others, from a depth of 1913 fathoms (upwards of two miles) between the Coasts of Greenland and Labrador." Dr. Wallich from whom we quote, believes "that the Coccospheres are the parents of the Coccoliths." See his article "On the Vital Functions of the Deep-sea Protozoa," *Monthly Microscopic Journal*, No. 1, Jan., 1869, 8vo, London. — *Eds. Nat.*

to separate them." * The relations subsisting between these Coccospheres on the one hand, and the Cyatholiths on the other, are very obscure; but Professor Huxley deems it probable that some close affinity does exist; but whether the Coccospheres have been formed from a coalescence of Cyatholiths, whether the Cyatholiths have resulted from the breaking up of the Coccospheres, or whether the Coccospheres are altogether independent structures, yet remains to be decided. There appears, however, no reason to doubt that Coccoliths, Coccospheres and Cyatholiths, equally belong to Bathybius, as the skeleton of a sponge, or the shell of a Foraminifer belong to their respective protoplasmic sarcodes.

Since Professor Huxley completed the observations to which I have referred, Dr. Carpenter and Professor Wyville Thompson have conducted a very important series of deep-sea dredgings off the north coasts of Scotland, and in the neighborhood of the Faroe Islands. In Capt. Dayman's dredging operations the viscid mud was found between the fifteenth and forty-fifth degrees of W. longitude. Those of Drs. Carpenter and Thompson were carried on much further eastward; but in the latter instance the same deposit was found over a range of at least two hundred miles, throughout which the dredge came up from time to time filled with Globigerina-mud and saturated with Bathybius, with its associated Coccoliths and Coccospheres. The Globigerina deposit exists in a similar manner in many and distant parts of the ocean, in both hemispheres; and it is more than probable that when the remote localities are subjected to the same examination as our northern seas have recently undergone, Bathybius will be found in them also. Its low organization renders it probable that it will be found to be like its companion Globigerina, a thorough cosmopolite. On this point Dr. Carpenter suggests that the range of these objects is regulated by temperature rather than by locality. It was

* On some Organisms from great Depths in the North Atlantic Ocean, *Quarterly Journal of Microscopical Science*, Oct., 1868, p. 209.

already known that many deep-sea localities existed, in which the Globigerina-mud did not occur; and it had even been suggested that its range was limited to that of the warm Gulf-stream. Dr. Carpenter confirms this general conclusion, and points out that its prevalence is connected with a bottom temperature of 45°, which in our northern latitudes can only be attributed to the Gulf-stream.

Bathybius yet requires to be considered in two other important relationships — the one geological and the other zoological.

Chalk, examined microscopically, has long been known to abound in minute ovate organisms, known as crystalloids, associated with the Globigerinæ and Textillariæ, of which chalk mainly consists. I recognized the organic origin of these bodies in 1847, and figured (Fig. 102) one of them very imperfectly, viewed as an opaque object, in my memoir "On some of the Microscopic Objects found in the Mud of Levant;"* but, ignorant of Coccoliths, I concluded that they belonged to some minute form of Oolina or Lagena. More recently Mr. Sorby has subjected these bodies to a much more careful examination, and both he and Dr. Wallich have identified them with Professor Huxley's Coccoliths. It now appears that both Coccoliths, Cyatholiths and Coccospheres, occur fossilized in the chalk, establishing, in a remarkable manner, the close resemblance of the conditions under which the chalk-beds were formed and those existing along the tract of the Gulf-stream at the present day. Dr. Carpenter goes even further than this, and regards it as "highly probably that the deposit of Globigerina-mud has been going on over some part or other of the North Atlantic sea-bed, from the Cretaceous epoch to the present time (as there is much reason to think that it did elsewhere in anterior geological periods), this mud being not merely *a* chalk formation, but a continuation of *the* chalk formation;

Fig. 102.

* "Trans. Phil. Soc., Manchester," Vol. viii, fig. 71.

so that *we may be said to be still living in the cretaceous epoch*."*

With the earlier part of the preceding paragraph I partly agree, but from its concluding sentence I must dissent. Chalk chiefly consists of an accumulation of Globigerina cretacea, *associated in almost equal proportions* with a minute Textillaria and with Coccoliths. The fossil Globigerina is probably but a mere variety of the recent G. bulloides; hence so far as it is concerned, ancient and modern deposits may have been continuous. But in none of the modern Globigerina beds which I have examined have I found anything resembling the fossil Cretaceous Textillaria, the disappearance of which requires to be accounted for. What I believe to be the same species occurs abundantly, amongst other modern types of Foraminifera, in the recent sandy deposit underlying Boston in Lincolnshire, but I never succeeded in discovering it living in the sea. From some unknown cause it has disappeared. On the other hand, our modern deposits abound in Diatoms and Radiolariæ, of which no trace appears in the true Cretaceous beds. That in the depth of the Atlantic Cretaceous and modern deposits may be conformably and continuously superimposed is not impossible, but conformable continuity of series does not constitute identity of age or of formation. In the Speeton clay of the Yorkshire coast we have, in the same blue deposit, a transition from the Oolites to the Cretaceous beds. The *deposits* have continued to accumulate without physical change from the one age to the other, but the *formations* to which the upper and lower portions of this clay belong are distinct, and represent distinct epochs. Dr. Carpenter is disposed to conclude that the higher forms of the Atlantic and Cretaceous faunæ will prove to be nearly identical; but I doubt this, and we must not repeat the blunder of Ehrenberg, in the case of the *tertiary* beds of the Mediterranean coasts, which he regarded as Cretaceous, because he found

* "Proceedings of the Royal Society," Vol. xvii, p. 192.

that they abounded in Cretaceous types of Foraminifera, overlooking the wide differences presented by the higher organizations of the two formations. So in the instance under consideration. Owing to the low vitality of the Protozoa, some of them have survived the changes which time has wrought in the higher groups of animals. The recent Globigerinæ and Bathybia are probably descendants from those which lived during the Cretaceous period, but their companions are not the same. The abundant Textillariæ are replaced by Diatoms and Radiolariæ. Instead of Marsupites we have the Rhizocrinus. The Ananchytes and Galerites are represented by Cidarites and Spatangi; amongst star-fishes Tosia (Goniaster) has given place to Ophiocoma. For the chambered Cephalopods we have the modern cuttle-fishes, whilst the Saurians and Ganoid fishes of the Cretaceous age have left no descendants in these Atlantic depths, their places being taken, in all probability, by the more familiar and much more useful codfish.

The zoological affinities of Bathybius are not very difficult to understand, though the young student is apt to become bewildered by the growing number of classifications of the Protozoa that are being offered for his acceptance, and the multitude of new terms with which, in consequence of these new classifications, our journals have become loaded. The last of these arrangements is that of Häckel, who has separated the Protozoa, under the name of Protista, equally from plants on the one hand and from animals on the other. He regards them as the common starting-point from which, in accordance with Darwinian ideas, both plants and animals have derived their origin. Without necessarily accepting this creation of a third organic kingdom, we may beneficially recognize Häckel's division of the Amæban section of the Protozoa into two groups, viz.: the Monera and the Protoplasta; the former comprehending those Amæbæ which exhibit an uniform granular sarcode without any trace of or differentiation into

special organs, and the latter including those types in which we have such special structures in the form of contractile vesicles, nuclei, or other differentiated appendages. So far as the structure of the sarcode is concerned, Bathybius is apparently a true Monera, and such its discoverer considers it to be. At the same time, the existence in connection with it of Coccoliths and Cyatholiths indicates the necessity for separating it from Häckel's other Monera, which have no such special appendages. But the time has not arrived for determining the absolute relations of these objects. New types, as Häckel himself admits, are being discovered, rendering modifications of his groups necessary. Meanwhile there can be no question that Bathybius is the lowest of those known Protozoa, which, like the Foraminifera, secrete calcareous elements. Remembering the extent to which the sarcode is diffused through the mud of the Atlantic, there appears much that is suggestive and important in the observation of Dr. Carpenter, that, had its power of secreting a calcareous framework been somewhat increased, so that instead of detached structures in the form of Coccoliths, etc., it had produced a continuous calcareous mass, it would have given us a living prototype of the Laurentian Eozoon. The discovery of this widely and continuously diffused Bathybius strongly sustains Dr. Carpenter in his conviction of the animal origin of that primæval structure.—*Popular Science Review*, October, 1869.

REVIEWS.

RESULTS OF DEEP SEA DREDGING BETWEEN CUBA AND FLORIDA.*—Mr. A. Agassiz makes a "Preliminary Report on Echini and Starfishes Dredged in Deep Water." Part 1st is devoted to descriptions of new genera and

* Bulletin of the Museum of Comparative Zoology, No. 9, Preliminary Report on the Echini and Starfishes Dredged in Deep Water between Cuba and the Florida Reef, by L. F. de Pourtales, Ass't U. S. Coast Survey. Prepared by Alexander Agassiz, pp. 253-318.

new species. The second part is "On the Young Stages of Echini." The collections of Count Pourtales included many very young specimens. With these Mr. Agassiz has been able to study the young of thirty odd different species belonging to as many different genera. These observations seem to us so important and interesting that we give below a few extracts showing some of the general conclusions at which the author has arrived and the direction in which his labors are likely to affect the received ideas of the relations of the Echini amongst themselves.

"The changes some species undergo are so great that nothing would have been more natural than to place the two extremes of the series not only in different species, but often in different genera, and even in different families."

The different stages of growth of *Toxopneustes drobachiensis* Ag., represent in the younger stages Cidaris, then Hemicidaris, then Pseudodiadema, Echinocidaris, and Heliocidaris.

In Cidaris, Diadema, and Garelia, the changes are less marked, and in Echinometra they are greater than in any other genus of the regular Echini.

"We frequently find specimens of the same size, where in one case the outline is almost circular, the test flattened, covered with long slender spines, while in the other the test is lobed, swollen, high, surmounted by numerous short stout spines.

Among the Clypeastroids we find in the young during their growth great changes of form and structure taking place."

The transformations of *Mellita testudinata* and *Encope emarginata* are described as identical, whilst those of *Mellita testudinata* and *Mellita hexapora* are not so much alike, although both of the same genus.

"The development of *Stolonoclypus prostratus*, and flat Clypeastroids of the type of *Clypeaster placunarius* is most instructive, tending to show that in connection with the development of the Scutellidæ above described, we must probably introduce a complete reform among the genera recognized as Lemtia, Scutellina, Runa, Echinocyamus and other minute Echinoids, which may eventually prove to be nothing but the young of other Clypeastroids, as Mellita, Scutella, Laganum, Stolonoclypus, Clypeaster, Encope, and the like; but want of sufficient material prevents me from entering into this comparison more in detail. Though we know now, from what has been said above, that the Scutellidæ pass through phases which cannot be distinguished from Moulinsia Fibularia, Runa, Scutellina, and the Clypeastroids proper pass, as I shall show below, through a stage of growth identical with Echinocyamus."

"The development of Echinolampas has thrown unexpected light upon the affinities of the toothless Galerites and of the Cassidulidæ. It shows conclusively that Echinoneus is only a permanent embryonic stage of Echinolampas, thus becoming allied to the Cassidulidæ, and that it has nothing in common with the Galerites as I would limit them, confining them entirely to the group provided with teeth."

This part of the work is full of important observations giving detailed descriptions of the development of the species in support of the general propositions a few of which we have quoted above.

Part No. III. is on their Bathymetrical and Geographical Distribution. Here Mr. Agassiz reaches a most important and interesting conclusion. He concludes, from a specimen of Ananchytes, probably *Ananchytes radiata* found on the Isthmus of Panama, that the Pacific and Gulf of Mexico were united during the Cretaceous period, and have since been separated by the gradual rise of the land. This rising of the Isthmus, separating first the deep sea Cretaceous forms, then those of the next zone, which Mr. Agassiz says are "representatively of Tertiary genera," and finally dividing the littoral species which are now represented by numerous

closely allied or identical species. The fact that we are now to look for zones of life in which the genera are representative of former geological ages from the Cretaceous upwards, according to their depth, if true, is not less interesting than Professor Forbes' original discovery of the bathymetrical distribution of marine forms. The investigators of the two faunæ have generally speaking agreed either in considering some of the species in their different branches of research as identical, or very closely allied, although found on different sides of the Isthmus. Prof. Verrill, however, at the last meeting of the American Association, showed that the massive reef building corals of the Atlantic side were, with the exception of the genus Porites, wholly wanting on the Pacific, a difference which could not be accounted for if there had been any very wide channel communicating between the two oceans since the existing species came into being.

Mr. Duncan, from his investigations in his article "On the Fossil Corals of the West Indian Islands,"* is disposed to admit the connection of the two oceans during the Tertiary Period and this upon the grounds that genera resembling the present Indo-Pacific forms predominated in the Tertiary formation over those which are allied to genera now existing in the Caribbean seas, and Mr. J. C. Morse,† who has examined the fossil shells of San Domingo, confirms this view so far as to admit that Tertiary species like those now living in the Pacific are found in the rocks of that island.

It would appear, therefore, from these conclusions, and those reached by Mr. Agassiz and Professor Verrill, that the connection of the faunæ must have been much more general in former geological periods, and that Indo-Pacific species actually did at one time cross their present boundaries and encroach upon the Atlantic, although subsequently driven back to their original limits.

The absolute identity of existing species of fishes common to both shores of Central America, and the similar physical conditions under which they exist, as pointed out by Dr. Günther,‡ forms another element in this curious problem.

If the developmental hypothesis is adopted, how shall we account for some species varying so as to become representative of each other after being separated for some time and others remaining invariably the same?

If some departed from their original types either by the direct action of physical causes or through natural selection, why did others, closely allied to them anatomically, remain unchanged? Why do we not have in the fresh-water lakes of Managua and Nicaragua some forms such as the Crustaceans and fishes found in the fresh-water lakes of Sweden, which were formed by the rise of the lands now dividing the Baltic from the Arctic Ocean?

Why did the Pacific fauna retreat after the Tertiary period, leaving, as

* Quarterly Journal Geological Society of London, xix, 1863. † Ibid., 1856.
‡ Trans. Zool. Soc., London. VI, p. 397, 1868.

Mr. Lyman shows below, the Caribbean fauna in undisputed possession of the Atlantic side, with outlying species on the Pacific shores?

Do Cretaceous forms occupy the depths, and Tertiary genera the middle ground of the coast on the Pacific side, and if so, what are the relations of these facts to the geological history of North America?

These are a few of the questions which present themselves and which can only be answered by farther investigation.

The expedition of the English government, sent out during the past season, dredged at the enormous depth of two thousand four hundred fathoms (nearly the height of Mont Blanc) and brought up living organisms. Though our own expeditions have not obtained specimens from such deep soundings the results have been none the less interesting.

It was announced by Professor L. Agassiz at the last meeting of the American Association, that it was the intention of the Superintendent of the Coast Survey to carry out other lines of sounding from the Atlantic side and still others from the Pacific shore.

The enlightened spirit of appreciation for the present needs of science displayed in these expeditions of the Coast Survey, and the great importance of the results they have already attained, promise to accomplish as much for the progress of Natural History in this country as they have hitherto for that of Geography and the Physical History of the sea.

Part IV. contains a "List of Star-fishes, which, though ranging through depths of from five to one hundred and seventy-four fathoms, present an unexpected departure from what was offered in other dredgings."

"With the exception of the Pteraster and *Asteracanthion tenuispinum* the bathymetrical and geographical distribution of the star-fishes do not show any striking features."

Mr. Lyman's report* on the Ophiuridæ and Astrophytidæ shows that all the new types of these families are found only below one hundred fathoms. Seven of these new genera are described at length. Mr. Lyman's conclusions are confirmatory of those published by Mr. Agassiz; he, however, does not seem prepared to go quite so far.

In showing that there are obstacles in the way of the hypothesis that the Gulf of Mexico and the Pacific were joined by a strait across what is now the Isthmus of Panama, the author asks a very pertinent question. Why do we not find Pacific forms on the Caribbean side? The evidence all goes to show that there has been a migration of species from the Caribbean to the Pacific, but none from the Pacific to the Caribbean. This objection has already been partially answered, as we have remarked above, by investigations upon the Tertiary shells and corals of the West Indian Islands.

Count Pourtales' report† gives us a descriptive list of the Crinoids.

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* No. 10, Bulletin of the Museum of Comparative Zoology. Report on the Ophiuridæ and Astrophytidæ dredged in deep water between Cuba and the Florida Reef, by L. F. de Pourtales, Assistant, U. S. Coast Survey. Prepared by Theodore Lyman. pp. 309-354.

† Bulletin of the Museum of Comparative Zoology, No. 11. List of Crinoids obtained on the Coast of Florida and Cuba, by the United States Coast Survey, Gulf Stream Expeditions, in 1867, 1868, 1869. By L. F. de Pourtales, Assistant, U. S. Coast Survey, pp. 355-358.

The late researches of Professor Sars upon the anatomy of this singular group has given it a preponderating interest to readers of these researches, and Count Pourtales' list shows that we may expect still greater additions to our knowledge. The author describes five new species of Antedon, and mentions that *Pentacrinus Müllerii* was found at a depth of two hundred and seventy fathoms off Havana, and at three hundred and fifteen fathoms off Double-headed Shot Keys, but not on the Florida side of the Gulf Stream.

Rhizocrinus Lofotensis has been obtained several times during the season of 1869, in depths varying from two hundred and thirty-seven to four hundred and fifty fathoms. The author also states that he has seen the collections of Professor Smith, made on the Josephine bank, a remarkable and almost precipitous elevation of the bed of the Atlantic, accidentally discovered by the Swedish Frigate Josephine between the coast of Portugal and the Azores. In this collection he saw *Rhizocrinus Lofotensis*, *Echinocucumis typica* and *Pteraster militaris*, species common to the coast of Norway and the deep sea fauna of the Gulf.

"The Holothurians* obtained in deep water off the Florida reef are few in number, and are very closely allied to, if not indentical with, those of the deep sea fauna of Norway. The littoral species, so abundant on the reef, do not appear to extend into even moderate depths outside, at least they were never found in the dredge."

Fossil Crinoids of Ohio and Kentucky.†—This article comprises descriptions of thirteen new species and two new genera, Hadrocrinus and Ataxiacrinus. Mr. Lyon has passed some thirty years in perfecting the collection which forms the basis of his descriptions in the neighborhood of the Falls of the Ohio, and the thoroughness of his descriptions derive additional value for the interesting character of this locality. The new species belong respectively to genera, Hadrocrinus, Actinocrinus, Cyathocrinus, Poteriocrinus, Platycrinus, Dolatocrinus, Ataxiacrinus, and Zeacrinus.

Monograph of the Phasianidæ.‡—Under this title Mr. Elliot, who is now in London, proposes to issue a companion work to his large and beautiful folio monographs of the "Grouse Family," the "Ant Thrushes," and his work on the "New and Heretofore Unfigured Birds of North America." The proposed work will contain figures, with accompanying text, of all the known species of Pheasants, Jungle Fowl, Turkeys, Pea Fowl, Guinea Fowl, etc. The plates will represent the species of life size and will be from original paintings by Wolf, lithographed by Keulemans and colored by hand. The monograph will be completed

* Bulletin of the Museum of Comparative Zoology, No. 12. List of Holothuridæ from the Deep Sea Dredgings of the United States Coast Survey. By L. F. de Pourtales, Assistant U. S. Coast Survey, pp. 359-361.

† Remarks on thirteen new species of Crinoidea from the Palæozoic Rocks of Indiana, Kentucky and Ohio; and a description of certain peculiarities in the structure of the columns of Dolatocrinus, and their attachment to the body of the animal. By Sydney S. Lyon. Transactions of Amer. Phil. Soc., Vol. 13, pp. 443-446, with two plates.

‡ By D. G. Elliot. Five parts, folio. Zoological Society, London.

in five parts, each part containing fifteen plates. Not more than two parts a year will be issued, and they will be sold to *subscribers only* at four guineas each part. This proposed work will be a handsome addition to the libraries of all who can afford so great a luxury, and we trust that, as the price is beyond the means of most students of ornithology, copies will at least be secured for the principal libraries of this country It will give us pleasure to forward subscriptions for the work, or Mr. Elliot can be addressed direct, care of the Zoological Society, London.

MONOGRAPH OF THE KINGFISHERS.* — We have already called attention to this beautiful monograph, six parts of which, containing the letter-press and plates of *forty-nine* species of this brilliant family of birds, have been received. The plates are most beautifully executed in colors by Mr. KEULEMANS, and the work is in every way worthy the support of Ornithologists in this country, and of all others who may wish for a handsome work for their library or drawing room. At present we notice that our own copy is the only one taken in America, but we trust that this will not be so long, and that before the last part is issued we shall see the names of several of our patrons of science on the list; but if they are to be there it must be done soon, as only two hundred copies of the work will be published, and the sixth number, issued in October last, shows already a list of one hundred and twenty subscribers. The work is to be completed in fourteen parts, each part containing at least eight plates. Professor MURIE is to contribute a chapter on the Anatomy and Osteology of the Kingfishers illustrated by plates.

A MONOGRAPH OF THE CAPITONIDÆ.† — We take pleasure in calling attention to the prospectus of this companion work to Mr. Sharpe's "Monograph of the Kingfishers." Like the latter birds, the Capitonidæ are possessed of the most brilliant and varied plumage, and considered as a whole, they are scarcely surpassed in beauty by any other family of the *Picariæ*.

"The authors feel that their experience in India has enabled them to gain a considerable knowledge of the general characteristics of the Eastern members of the family, while the recent exertions of Naturalists in Africa and South America, have materially contributed to elucidate the economy of the Barbets inhabiting these portions of the globe. While acknowledging the great amount of work that has been done of late years with regard to the Barbets, the authors cannot but believe that a Monograph of the family, giving full descriptions of the birds, their structure, habits, and general economy, accompanied by good illustrations of every species, will be an acceptable contribution to Ornithological Science. To render the work up to the standard which the present state of Science demands, no efforts will be spared; and it is intended to be not only a trustworthy hand-book of reference to the scientific student, but also a handsome addition to the Library or the Drawing-Room. The fact that the plates will be executed by Mr. J. G. Keulemans will be a sufficient guarantee for the excellence of this portion of the undertaking."

* By R. B. Sharpe. Fourteen parts, 4to. Zoological Society, London. The subscription price of this work is 10*s.* 6*d.* each part. Orders will be taken at the *Naturalists' Agency* at the rate of $3.50 (currency) a part, or subscribers can remit directly to the authors, care of the *Zoological Society*, 11 Hanover Square, LONDON, W.

† By C. H. T. Marshall and G. F. L. Marshall. Eleven parts, 4to. Zoological Society, London. We shall be pleased to forward subscriptions at the same rates as for the "Monograph of Kingfishers," or the authors can be addressed care of the Zoological Society.

The work will be published in quarterly parts. Each part will contain eight beautifully colored lithographs, with accompanying letter-press. The whole work will contain about eighty plates, and will be completed in eleven parts. The first number is announced for January, 1870.

The Geology of Alaska.*—The most interesting results of Mr. Dall's explorations are the determination of the facts that west of the 105th degree of longitude the Alaskan coast is rising, that the former violence of volcanic forces is diminishing throughout the territory, and that there are no evidences of general glacial action. Mr. Dall has travelled thirteen hundred miles up the valley of the Yukon, and explored on the shores of Norton Sound, without obtaining any evidences of glacial action. The whole territory north of the Alaskan Mountains could not, therefore, have been covered by the same general sheet of ice which has scratched the section east of the Rocky Mountains.

This raises an unexpected obstacle in the path both of the hypothesis of a general terrestrial glacial sheet, and the theory of floating ice. In either case it will be difficult to explain the absence of scratches on the northern slope of the Alaskan Mountains when all the rest of North-eastern America must have been covered by ice.

If Alaska was covered by the waters of the Pacific, why did not the floating icebergs score the surface, and if it was out of water during the glacial epoch, why did not the great terrestrial glacier of the east have its counterpart in the Arctic valley of the Yukon?

NATURAL HISTORY MISCELLANY.

BOTANY.

Spontaneous Motion of Protoplasm.—Professor J. B. Schnetzler records in the "Archives des Sciences Physiques et Naturelles," some observations on the spontaneous motion of the protoplasm in the cells of the leaves of the common water weed, *Anacharis alsinastrum*. The writer remarks that whether the cause of the motion is found, as some have maintained, in the successive contractions or vibrations of the exterior layer of the protoplasm, which transmit themselves to the interior layers; or whether the successive displacements of the molecules is produced by causes purely mechanical, as others have held, it still remains to be explained what produces these contractions or displacements. It is incontestable that they are found only in living protoplasm. Professor Schnetzler believes that the principal cause which provokes the motion

*Observations on the Geology of Alaska, by W. H. Dall, 8vo, pamph., 12 pp. From the Alaska Coast Pilot, published by the Coast Survey.

is the chemical action of oxygen, which passes through the wall of the cell, and of which a portion is probably transformed into ozone under the influence of light, as occurs also in the globules of blood. The most strongly refracted rays of light have a marked influence on these currents, which are also no doubt affected by the currents of electricity which form, under the influence of water, between the surface of the leaf and the contents of the cells. The energy of the motion depends principally on the temperature, showing the greatest vigor between 16° and 20° C. In the point of view of mechanical theory, we have here evidently an example of the transformation of light and of heat into motion. The Anacharis is especially favorable for the observation of these motions; as, in consequence of the transparency of its tissue, they can be watched under the microscope without any preparation. — *Nature, London.*

STRAWBERRIES. — Of the *Everlasting Andine Strawberry*, which seems to attract considerable attention in England, Dr. Spruce, the celebrated botanical traveller in South America, writes that it is "doubtless one of those varieties of *Fragaria vesca* commonly cultivated throughout the Andes within the tropics, where the perpetual spring of that favored region has had the effect of rendering the strawberry perennially fruitful, and many of the deciduous-leaved trees of Europe evergreen. In the Equatorial Andes the province of Ambato is famous for its strawberries, which equal in size and flavor some of our best varieties, and which are to be seen exposed for sale in the market-place every day in the year." — *Gardeners' Chronicle, Dec.* 11.

ANOTHER WHITE VARIETY. — During the summer of 1868, while near the White Mountains, New Hampshire, I observed a white variety of *Epilobium angustifolium*. As I have not seen this mentioned in the NATURALIST, I contribute it to the list of floral albinos which has been so largely increased the past season. In the NATURALIST of several months ago, a white variety of *Viola cuculata* is spoken of by a Western writer. This color I do not think is unusual in this species, as I have observed it during the past ten years in Saratoga Co., N. Y., and have also seen it elsewhere. — HENRY M. MYERS, *Williamstown, Mass.*

BOTANICAL SPECIMENS. — A. H. Curtiss, Liberty, Bedford Co., Va., has botanical specimens (catalogue furnished) for exchange for specimens of Minerals, Geology, Shells and Insects.

ZOÖLOGY.

OCCURRENCE OF AN AMERICAN LAND SNAIL IN ENGLAND. — In a communication to the November number of the "Annals and Magazine of Natural History," by J. Gwyn Jeffries, the occurrence of *Planorbis dilatatus* Gould, is noticed at Manchester, England. Since it was found in a canal near the cotton mills, the writer suggests that in some way the eggs might have been conveyed there in the cotton from America, and thus intro-

duced the species. *Planorbis dilatatus*, however, does not occur in cotton growing regions, and therefore some other explanation must be made for its importation into England. Lately, *Bythinia tentaculata*, peculiar to Europe, has been found in the vicinity of Montreal. Whether these species are transported from one country to the other through commercial intercourse, or are really circumpolar species which have thus far eluded the collector's eye, must be decided by looking for the species in various and widely separated regions of the country.

"ZOOLOGICUS" has succeeded in misconceiving some very plain statements and in supplying some very rudimentary zoölogical information, which perhaps no reader of the "lilies" has felt the need of. The parallel drawn in the "lilies" is correct. The hexagonal form results in microscopic structures from equal growth in the three hexagonal axes; in the crystal it results from the aggregation of hexagonal particles. The other misconceptions of "Zoölogicus" are so peculiarly his own that they need not be noticed. — CHEMIST.

THE MUSEUM OF COMPARATIVE ZOÖLOGY is prepared to furnish extensive collections of all the rocks and loose deposits found upon and about the keys and reefs of Florida; also complete collections of the corals, in fresh and well preserved specimens, in exchange for recent and fossil corals from other parts of the world. Address, L. AGASSIZ, *Director of the Museum of Comparative Zoölogy, Cambridge, Mass.*

PROFESSOR AGASSIZ. — "Our Young Folks" for January contains the best portrait of Professor Agassiz that we have ever seen, and we advise all who have not seen him, and wish to know how he looks, to send twenty cents to Fields, Osgood & Co., Boston, for a copy of the number, which also contains "A Sketch of the Life of Professor Agassiz."

OBITUARY OF MICHAEL SARS. — We have received a circular from the Royal University of Norway, announcing the death of Professor Michael Sars, from which we take the liberty of making a few extracts. Professor Sars was one of the foremost of those men whose attainments have of late years given a cosmopolitan reputation to Scandinavian science and literature. He died on the 22d of October, being then sixty-four years of age. Professor Sars graduated in theology in 1828, and subsequently presided in succession over the parishes of Bergen and Manger. His theological career appears to have been adopted merely as a means of gaining a livelihood, and, as it has been stated by an obituary notice in the "Scientific Opinion," the Sunday services were sometimes delayed when the pastor had met with unusual good fortune in his dredging trips. In 1854 he was appointed Extraordinary Professor of Zoölogy, a position which conferred upon him the precious boon of uninterrupted study. The life of this eminent Norwegian is full of encouragement to many American naturalists, many of whom are located, as Sars was until 1854, far away from books or museums, and obliged to work out their investi-

gations with "poor and incomplete" instruments. During the period referred to, Professor Sars completed many of his finest researches and began his greatest single work, the "Fauna Littoralis Norvegiæ."

GEOLOGY.

EVIDENCES OF THE GULF STREAM IN HIGH LATITUDES. — Admiral C. Irminger of the Danish Navy, has for nearly thirty years made observations on this subject, and states that "it can be said with certainty that the current in the Northern Atlantic flows towards the north, even up to the Icy Sea." Between Fairhill and Greenland a constant drift or slow current of the ocean, to the north was observed; and the mean of observations between 32° and 39° W. of Greenwich gave 3:2 nautical miles per day north. This drift of the ocean in a northerly direction towards the coast of Greenland, is besides observable in the temperature of the water.

This drift, or slow current in the Atlantic, is the cause why the harbors of Norway, even farther than North Cape, and as far as the Fiord of Varanger, are accessible for navigation during the whole year; just as the warm current, which passes Cape Reikianæs, and runs to the northward along the western shores of Iceland, is the cause of the south and west coasts of this island being clear of ice, so that, even during the severest winters, ships may go to Havneford and other places in the Faxe bay of Iceland, where they always will be sure of finding open sea. If this current to the north in the Atlantic did not exist, the ice from the sea around Spitzbergen would float down to far more southern latitudes than is now the case; and certainly the coasts of Norway, as well as the sea between Shetland and Iceland, would frequently be filled with ice from the Icy Sea, and the influence of the ice would then be felt on the climate of the neighboring coasts. But this is not the case, and we know that the ice from the Icy Sea (Greenland ice) only can force its way to the southward between Iceland and Greenland, along the east coast of Greenland, rounding Cape Farewell, and afterwards passing Labrador, Newfoundland, and farther south."

Between Shetland and Cape Farewell there are found streaks of warmer water which are supposed to have their origin from the Gulf Stream. These may possibly be caused by the pressure of the current coming from Labrador, passing Newfoundland, etc., where this current influences more or less the limits of the Gulf Stream, causing its heated waters to be inclined sometimes more easterly, and at other times more westerly. "These warmer streaks, combined with the different tropical products, constantly thrown on the shores of Norway, the Faroe Isles, Iceland, Greenland, etc., I believe also to be a proof that the Gulf Stream sends its waters far to the north. Among the tropical products frequently found is the bean of the *Mimosa scandens*, which I found on the shores of Iceland. — *Scientific Opinion.*

ANSWERS TO CORRESPONDENTS.

C. G. A. Augusta, Maine. — The shrub from Schoodic River is *Lonicera cærulea*, or Mountain Fly-honeysuckle. The plant from Fox Island, Phippsburg, Maine, is *Polygonatum latifolium*, or Broad leaved Solomon's Seal. — J. L. R.

J. H. P., Portsmouth, N. H. — Your specimen is *Coccoloba platyclados*, a singular plant of the order of the Polygonums, or Knot weeds, and lately much cultivated. — J. L. R.

BOOKS RECEIVED.

Geological Report of the Exploration of the Yellowstone and Missouri Rivers. By F. V. Hayden. 8vo, pp. 174. Maps. (Government Report) 1869.

Annual Report of the Secretary of the Interior for the year 1869. 8vo, pp. 26. Washington.

Scientific Opinion. London. December 1, 8, 15, 22, 29.

Volcanoes and Earthquakes: a lecture by T. Sterry Hunt. New York, 1869. 8vo, pp. 10.

Description of a New Species of Grapta, and Notes on G. interrogationis. By J. A. Lintner. 8vo, pp. 8. 1869.

Abhandlungen der Naturwissenschaftliche Verein zu Bremen. Bd. 2. Heft. 1.

Entomological Verein zu Stettin. 30 Jahr. Nos. 1-3. Jan. — Meh., 1869. 8vo.

From the Kongliga Svenska Vetenskaps-Akademien, Stockholm. — *Handlingar.* 1864-7. 4to. — *Ofversigt.* 1865-68. Vols. 22-25. — *Meteorologiska lakttagelser,* 1864-6. 4to. — *List of Members,* 1866-9. — *Sketch of Geology of Spitzbergen,* by A. E. Norden. 8vo, plates and maps. — *On some Fossils found in the Eophyton Sandstone at Lugnas in Sweden,* by J. G. O. Linnarsson, 8vo. — *On the Existence of Rocks containing Organic Remains in fundamental Gneiss of Sweden.* 8vo. — *Om Gotlands nutida Mollusker* of G. Lindstrom. 1868. — *Conspectus Actum Picinarum,* by Sundeval. — *Thieracten des Aristoteles,* by Sundeval. — *Hemiptera Africana,* by C. Stal. Vols. 1-4. — *Lefnad Steck unger,* etc. Bd. 1, Heft, 1.

Report of the Commissioner of Agriculture for the year 1868. 8vo, pp. 671. Washington, 1869.

Notice of New Mosasauroid Reptiles from the Greensand of New Jersey; Description of a New and Gigantic Fossil Serpent from the Tertiary of New Jersey; Description of a New Species of Protichnites from the Potsdam Sandstone of New York. By O. C. Marsh. 2 pamphlets, 8vo. [Extracted from American Journal of Science, 1869.]

Le Naturaliste Canadien. Vol. ii. No. 1. Dec., 1869. Quebec.

The American Horticultural Annual for 1870. 12mo, pp. 150; and *The American Agricultural Annual* for 1870. 12mo, pp. 150. New York. Orange Judd & Co. 50 cts. each.

On the Nature of the Movements involved in the Changes of Level of Shore Lines. By N. S. Shaler. 8vo, pamph. pp. 11. [From Proceed. Bost. Soc. Nat. Hist.] 1868.

On the Proximate Composition of Several Varieties of American Maize. By W. O. Atwater. pp. 9. [Extracted from Amer. Journ. Sci. and Arts.] 1869.

Beast, Bird and Fish. By B. G. Wilder. [From Harper's Magazine, 1869.]

Notice of the Crustacea collected by Professor C. F. Hartt on the Coast of Brazil in 1867, together with a List of the described species of Brazilian Podophthalmia. By SIDNEY I. SMITH. [From the Trans. Connecticut Acad. of Arts and Sciences. Vol. ii.] 8vo, pp. 42. Plate. 1869.

Hindrances and Helps to the Advancement of Agriculture. By George Buckland. 8vo, pp. 52. Albany. New York State Agricultural Society. 1869.

Synopsis of Corals and Polyps of the North Pacific Exploring Expedition. Part iv. Actinaria, with Supplement and Geographical List. By A. E. Verrill. pp. 70. Plates. [From Proceed. Essex Inst. Vols v-vi. 1868-69.]

Notes on the Geology of Western Texas and of Chihuahua, Mexico. By James P. Kimball. [From Amer. Journ. Sci., 1869.] pp. 11.

Tidsskrift for Populære Fremstillinger af Naturvidenskaben. Oct., 1869. 8vo. Kjobenhavn.

Annals of the Lyceum of Natural History of New York. Vol. ix, No. 8. December, 1869.

Mammalia of Massachusetts. By J. A. Allen. Bulletin of the Museum of Comparative Zoology, No. 8. pp. 145-253. 1869.

American Journal of Numismatics. Vol iv, No. 8. Dec., 1869. New York.

The Chemical News, with American Supplement. Dec., 1869. Vol. v, No. 6.

The Annals of Iowa. October, 1869. Davenport. 8vo.

Report upon Deep-Sea Dredgings in the Gulf Stream, during the Third Cruise of the U. S. Steamer Bibb, addressed to Prof. B. Peirce, Supt. Coast Survey, by L. Agassiz. Bulletin of the Museum of Comp. Zoology. No. 13. 8vo, pp. 383-386. Cambridge, 1869.

American Bee Journal. December.

Bulletin of the National Association of Wool Manufacturers. Vol. i, No. 4. Oct., 1869. Boston. 8vo, pp. 397-419.

The Canadian Naturalist and Quarterly Journal of Science with the Proceedings of the Natural History Society of Montreal. Vol. iv, No. 3. Sept., 1869. Dawson & Bros. Montreal.

Land and Water. Nov. 6, 13, 20, 27. London.

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C. B. Brigham of Boston, Mass., ... 131, 207, 373
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Rev. J. W. Chickering, jr. of Exeter, N. H., ... 128
Prof. Cleland (copied from Popular Science Review, London), 586
J. G. Cooper, M.D. of San Francisco, Cal., 31, 73, 124, 182, 470, 294, 405
A. Coolidge, M.D. of Boston, Mass., ... 288
Prof. E. D. Cope of Philadelphia, Pa., ... 84
Elliot Coues, M.D., U. S. Army, ... 337, 600
Wm. H. Dall of Washington, D. C., ... 35, 236
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Prof. A. M. Edwards of New York, N. Y., ... 313, 427, 561
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Prof. F. V. Hayden of Philadelphia, Pa., ... 113
W. J. Hays of New York, N. Y., ... 180
Prof. G. Hinrichs of Iowa City, Iowa, ... 299
J. G. Hunt, M.D. of Philadelphia, Pa., ... 13
Joseph Jones, M.D. of New Orleans, La., ... 57
John L. LeConte, M.D. of Philadelphia, Pa., ... 307
Rev. Samuel Lockwood of Keyport, N. J., ... 261
E. S. Morse of Salem, Mass., ... 21, 269, 530, 648
Prof. James Orton of Poughkeepsie, N. Y., ... 539
A. S. Packard, jr., M.D. of Salem, ... 364
George A. Perkins, M.D. of Salem, ... 360
Rev. George E. Post of Palestine, ... 121
F. W. Putnam of Salem, Mass., ... 617
Robert Ridgeway of Washington, D. C., ... 309
Henry Shimer, M.D. of Mt. Carroll, Ill., ... 91
R. E. C. Stearns of San Francisco, Cal., . 1, 250, 281, 349, 397, 455
T. Martin Trippe of Orange, N. Y., ... 291
Prof. A. E. Verrill of New Haven, Conn., ... 239
Charles A. Walker of Chelsea, Mass., ... 136, 189, 481
Prof. W. C. Williamson (copied from Popular Science Review, London), ... 651
William Wood, M.D. of East Windsor Hill, Conn., . . 17, 393
Bryce M. Wright, jr. of London, Eng., ... 449

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GLOSSARY.*

Accipitres. The Hawks, Falcon, and Eagles.
Achromatic. Free from color.
Amœboid. Like Amœba, an animal of a soft, jelly-like structure and no specialized organs.
Ambulacra. The narrow spineless zones, perforated by the fleshy suckers of the Sea-urchins and Starfishes.
Anadromous (Gr. *ana*, upwards; *dromos*, course). Relating to the classes of fish that pass at certain seasons, from the sea into the rivers.
Apical. Relating to the apex or top.
Archæopteryx. A fossil reptile-like bird.
Amnios. The membrane that surrounds the fœtus in the womb.
Azotized. Impregnated with azote, nitrogen.

Cardiac. Relating to the heart.
Cecidomyian. Relating to a family (Cecidomyidæ) of Diptera.
Carapace. Shell of turtles and other reptiles.
Chlorophyl (Gr. *chloros*, green; *phullon*, a leaf). The green matter in plants.
Chironectes (Gr. *chir*, hand; *nectes*, a swimmer). The Yapock. A genus of marsupial animals with webbed feet.
Columellar. Relating to the columella, or central axis of a shell.
Copepoda. An order of minute Crustaceans, or Crabs.
Coracoid. A large, flattened bone, passing from the shoulder-joint to the sternum.

Dinosaurs (Gr. *deinos*, terrible; *sauros*, a Lizard). An order of fossil reptiles.

Foraminifera (Latin, *foramen*, a hole; *fero*, to carry). Perforated shells secreted by an Amœba-like animal, and belonging to the Protozoa, or lowest branch of the animal kingdom.

Gasteropoda. Mollusca, generally with a single coiled shell and the creeping disc or foot below, as in the snails.
Globigerina. A genus of Foraminifera.
Graptolites. Fossils of the Silurian period; probably Jelly-fish, or Hydroids.

Heterocercal. Fishes with the upper lobe of the tail larger than the lower.
Hexapodous. Relating to an animal with six feet.
Holothuria. A genus of the Echinoderms (Sea-cucumbers).
Hydrozoa. The Jelly-fish, or Acalephs.

Lemurs. A genus of Quadrumana, or Monkeys.
Lepidosirens. A genus of the Batrachians closely allied to the fishes in some of their characteristics.
Lingula. A genus of the Brachiopods, or Lamp Shells.

Marsupial (Gr. *marsupion*). Pertaining to an order of Mammalia, which carry the young in a pouch.
Mesentery. A fold of the membrane lining the abdominal cavity, which suspends and holds in place the small intestine.
Mesas. Name given to the elevated plains west of the Rocky Mountains.
Metatarsal. Relating to the metatarsus, or instep bones.
Miocene. The second division of the Tertiary epoch.
Monotremata (Gr. *monos*, single; *trema*, a hole). An order of Mammalia with a single orifice posteriorly into which the genitals and intestine open.

Negundo.† A genus of timber-trees, having pinnated leaves and apetalous flowers.
Neural. Pertaining to a nerve.
Nullipore (*nullos*, none; *porus*, a pore). A genus of Corallines, or plants of a low order, which cover themselves with a limy secretion.
Notochord. Chorda dorsalis of the embryo, usually replaced by the spinal column of the adult.

Odontoid. Resembling a tooth.
Operculum (*Operio*, to cover). The bones which protect the gills of fishes. In Mollusks the valve which closes the shell of a snail.
Oroviviparous. Animals which hatch their young from an egg within the body, their young being excluded alive.

Pseudova. False-eggs, as in the ovary of the asexual Plant-lice.
Phryganidan. Relating to the Phryganidæ, a family of insects containing species of Caddice-flies.
Picrotoxia (Gr. *pikirs*, bitter; *toxikon*, poison). The poisonous principle of an East Indian plant.
Plesiosaurians. Fossil reptiles of the Jurassic Period, with a long snake-like neck and short boat-like body.
Protoplasmic. Soft, structureless animal matter, such as the sarcode of Amœba.
Proteus. A genus of Batrachians, or naked reptiles such as the frog and salamander, or water newt.

Ramus. A twig or branchlet.
Rhizopods (Gr. *riza*, a root; *pous*, a foot). A

* No terms are explained here which can be found in the Glossary of Vols. I and II.
† The derivations and meaning of botanical names are fully given in Gray's Manual of Botany.

class of minute animals, including the Foraminifera.

Sarcode. The jelly-like tissue of the Amœba, sponges, etc.

Sertularian. Relating to Sertularia, a genus of Jelly-fish (Hydroids).

Tarsus. The heel and ankle bone.

Teratology (Gr. *teras*, a monster; *logos*, a discourse). A branch of science which treats of the monstrosities and malformations of the animal and vegetable kingdoms.

Tibia. Large bone of the human leg, the shin bone.

Trachea. The air vessels of insects, serving as lungs.

Triton. A genus of Salamanders.

Trochiform. Like the Trochus, a genus of marine Gasteropods; top-like.

Tubularia. A genus of jelly-fish (Hydroids).

Vascular. Containing blood-vessels, or relating to the circulatory system.

Visceral. Relating to the intestines and other organs of digestion.

INDEX TO VOLUME THREE.

Abalones, 250, 255.
Abert's Finch, 472. Abert's Pipilo, eggs of, 476.
Abies amabilis, 410. 419. A. Canadensis, 130, 412. A. Douglassii, 185, 411, 415, 419. 420. A. grandis, 410, 419. A. Menziesii, 410, 419, 420. A. Mertensiana, 412, 419. 420. A. nigra and alba? 416. A. taxifolia, 411. A. Williamsoni, 412, 419, 420.
Abnormal Forms of Plants, 381. [57.
Aboriginal Mound Builders of Tennessee.
Aborigines of De Soto's time, 63.
Abranchiate vertebrata, 607.
Acacia, 439.
Acalephs, 266, 543.
Acantholimon Libanoticum, 122.
Acarian mites, 371.
Acarina, 365.
Acarus, 366, 367, 371, 389. A. farinæ, 372. A. malus, 365. A. sacchari, 371. A. siro, 372.
Accipenser sturioides, 220.
Acer dasycarpum, 130. A. glabrum, 406, 416, 419, 420. A. rubrum, 130. A. saccharinum, 613. A. tripartitum, 406.
Achlysia, 369.
Acomus lactarius, 126.
Actinemys marmorata, 189.
Actinia, 43.
Actinians, 500.
Actinobolus (Cyclocardia) Novangliæ, 380.
Actiturus Bartramius, 83, 298.
Actodromus Bonapartei, 639.
Adamsia, 247, 249. A. maculata, 247.
Adenocaulon bicolor, 156.
Admete viridula, 274.
Adocus, 88.
Ægialites, 340. Æ. melodus, 231. Æ. montanus, 82, 298. Æ. vociferus, 182.
Ægiothus fuscescens, 583. Æ. linaria, 583.
Afternoon in Nicaragua, 35.
Agaricia, 500.
Agassiz's Land-tortoise, 189.
Agave Americana, 399.
Age and relations of the Metamorphic rocks of N. Brunswick and Maine, 442.
Agelacrinus, 495.
Agelaeus phœniceus, 78, 508.
Albatros, 235.
Albino Robins, 279,
Alca impennis, 225, 384, 539, 644.
Alcyonium, 156.
Alecto, 276.
Alexandrite, 304.
Algæ, 164, 166, 284, 313, 564.
Algæ, Mounting bleached specimens of, 167.
Algæ, how to procure specimens of, 167.
Algansea formosa, 189.
Algarobia glandulosa, 471.
Alligator Mississippiensis, 465.
Alligator Pear, 401.
Allium, 163.
Alnus Oregona, 408. A. rubra, 419. 421. A. viridis, 416, 408.
Alpine Hare, 115.
Alpine strawberries, 329.
Alyssum montanum, 122.
Amblodon grummens, 297.
Amblystoma, 441.
Amelanchier alnifolia, 81, 407, 418. A. Canadensis, 407.
American Aloe, 399.
American Association for the Advancement of Science, 223, 335, 435.
American Bittern, 178.
American Buzzard, 397.
American Coot, 231.
American Crow, 384.
American Entomology, Record of, 101.
American White Pelican, 640.
American Yew, 130.
Amentaceæ, 438.
Amia, 609.
Ammodramus, 229. A. caudacutus, 634. A. rostratus, 186.
Ammonoosuc Gold Field, 440.
Amœba, 180.
Amœboid movements in Eggs, 110.
Ampelis cedrorum, 34, 413. A. garrulus, 473, 579.
Amphibia, 107.
Amphibians, 609.
Amphinomeæ, 215.
Amphioxus, 501, 609.
Amphipods, 156, 242, 243.
Ampullariæ, 38.
Anacharis alsinastrum, 668. A. Canadensis, 376.
Ananchytes, 661. A. radiata, 663.
Anas boschas, 83. A. clangula, 384.
Ancestry of Insects, 45.
Ancient Tennessee Rock Paintings, 60.
Ancistrodon contortrix, 159.
Ancylus, 650.
Andreæa, 218.
Anemone, 163. A. cylindrica, 6. A. Pensylvanica, 6.
Anhinga, 41, 42.
Anilocra, 242.
Animals for the fresh-water Aquarium, 486.
Animals, Habits of, 216.
Animal Parasites, 41.
Animal specimens, Method of preserving for fine dissection, 498.
Annals of Bee Culture, 494.
Annelids, 494.
Annulata, 215.
Anopolonassa forcipata, 444.
Anser hyperboreus, 183.
Annuloida, 543.
Annulosa, 543.
Anodon, 369.
Anomma arcens, 361.
Anonyx, 244.
Antedon, 276, 496. A. rosaceus, 277. A. Sarsii, 277.
Antelope, 186.
Anthocaris Genutia, 212, 330.
Anthozoa rugosa, 216. A. tabulata, 216.
Anthropatæmon, 45.

Anthropoid Apes, 501.
Antillean Tern, 340.
Antilocapra Americana, 186.
Antiquity of Man, 542.
Antrozous pallidus, 472.
Ants, 38, 360.
Anvil-rock Sandstones, 44.
Aphis, 491.
Aphis, reproduction of, 490.
Apiocrinite, 108.
Apiocrinus, 276.
Aporrhais occidentalis, 274, 277.
Apple-snail, 38.
Aquarium, Best tank for, 134, 135.
Aquarium, Fresh-water, 131, 207, 373, 486.
Aquarium, How to arrange it, 208, 209, 210.
Aquarium, Plants for, 373, 374.
Aquila Canadensis, 568. A. chrysaëtos, 558.
Arachnida, 168, 433, 543.
Arachnids, 365, 371.
Aranea lobata, 216.
Arboreal Finches, 75.
Arca grandis, 236. A. Noæ, 467.
Archæopteryx, 502, 607, 609.
Archencephala, 608.
Archibuteo ferrugineus, 183. A. lagopus, 518. A. Sancti-Johannis, 518.
Archæocidaris Agassizii, 305.
Arctic Bluebird, 32, 189.
Arctic Ground Finch, 78.
Arctic Tern, 234, 642.
Arctomys flaviventer, 299. A. monax, 390.
Ardea herodias, 82, 401, 517.
Arenicola cristata, 246.
Arethusa bulbosa, 381, 382.
Argas, 370. A. Persicus, 370.
Argemone, 163.
Argiope, 385. A. scricea, 216.
Argonaut, 238.
Argonauta, 237. A. argo, 238. A. Nouryi, 239.
Argonaut, Notes on, 236.
Argulus, 241.
Argynnis Aphrodite, 330. A. Atlantis, 330. A. Bellona, 212, 330. A. Cybele, 330. A. Idalia, 330. A. Montinus, 330. A. Myrina, 330.
Argytria maculata, 645.
Arizona Long Sparrow, 474.
Arkansas Flycatcher, 309.
Arkansas Kingbird, 477.
Ark shells, 286.
Arma spinosa, 98.
Army worm, 168.
Arquatella maritima, 639.
Arrowheads, 211.
Arsenic, 307.
Arsenical soap, 137.
Artemia, 501.
Artemisia, 115, 357, 359, 360. A. cana, 357. A. filifolia, 357. A. tridentata, 357.
Articulates, 240, 291, 501, 543.
Artificial preparation of substances found in Plants and Animals, 613.
Artocarpus incisa, 351.
Ascidia, 611. A. callosa, 383.
Ascidians, 156, 543.
Ascidians, Parasites of, 383.
Ascidian Polyp, 249.
Asclepiads, 388.
Asclepias incarnata, 389. A. purpurescens, 389.
Asclepias pollen, Honey Bee killed by, 388.
Ash-colored Cantharis, 96.
Ash-leaved Maple, 405.
Aspen, 409.
Aspergillum Javanicum, 453.
Aspidium aculeatum, new locality of, 495.
Asplenium thelypteroides, 448.
Astarte castanea, 272. A. sulcata, 272.
Asterocanthion tenuispinum, 665.
Asteroids, 612.
Asters, 8.
Astræans, 43, 352, 500.
Astragalinus tristis, 583.
Astragalus, 122, 359. A. lanatus, 122. A. Mexicanus, 162.
Astur atricapillus, 516.
Atax Bonzi, 491.
Athene cunicularia, 101, 183, 475.
Atomizer, 308.
Attacus Yama mai, 53.
Atthis costæ, 475, 477.
Audubon's Hare, 476.
Audubon's Warbler, 33, 183.
Auks, 345.
Auk, The Great, 539.
Aurelia, 243.
Auriparus flaviceps, 474.
Aythya vallisneria, 639.
Azalea, 7.

Badger, 183, 476.
Baird's Finch, 513.
Baird's Hare, 115.
Baird's Sparrow, 631.
Balænoptera rostrata, 53.
Bald Eagle, 397.
Balenoptera musculus, 220. B. Sibbaldii, 220.
Baltimore Oriole, 509.
Band Tailed Pigeon, 80.
Bank Swallow, 474.
Barbarea vulgaris, 130.
Barn Owl, 513, 570, 646.
Barn Swallow, 12, 33, 228, 477.
Barred Owls, 227, 384.
Bascanion constrictor, 158.
Bathybius, 108.
Batrachia, 609.
Batrachians, 628.
Bay-breasted Warbler, 578.
Bay-winged Bunting, 202.
Bay-winged Sparrow, 631.
Beasts, Book of, 46.
Bee Keeping, 40.
Bee Martin, 309.
Beets, 96.
Bela harpularia, 273. B. turricula, 274.
Bell's Finch, 184.
Belted Kingfisher, 11, 53, 230.
Benzoin odoriferum, 130.
Bernicla Canadensis, 83. B. Gambelii, 182.
Betula occidentalis, 408, 416, 419, 420, 421. B. papyrifera, 408. B. resinosa, 408.
Bia sacatsjo, 250.
Bicho, 258, 386.
Bicolored Swallow, 474.
Bidens frondosa, 388.
Bigelovia, 359.
Big Mound of St. Louis, origin of, 547.
Bimeria, 616.
Binarseniate of potassa, 307.
Birds, 215, 609.
Birds, Book of, 46.
Birds, Breeding Habits of, 48.
Birds, Difference in song of, 510.
Bird's Eggs, 387.
Bird's Eggs, preparation of, 106, 384.
Bird Mite, 366, 373.
Birds of New England, Dr. Coues' addenda to list of, 513.

Bird Parasites, 41, 111.
Birds, Rarer of Massachusetts, 505.
Bird's Skins, On preparing dried ones, 200.
Bitterns, 169.
Bittern, Color of Eggs of, 173, 174.
Bizchaca, 100.
Black and White Creeper, 509.
Black-backed Three-toed Woodpecker, 572.
Black-bellied Plover, 231.
Black-billed Magpie, 80.
Blackbird, 287.
Blackburnian Warbler, 577.
Black Cantharis, 96.
Black-cap Tit, 384.
Black-cap Warbler, 480.
Black Creeper, 202.
Black Duck, 506.
Black Hawk, 228, 518.
Black-headed Grosbeak, 75, 295.
Black-headed Gull, 234.
Black-necked Stilt, 638.
Black Pewee, 183.
Black Snake, 158.
Black Spruce, 410.
Black-tailed Deer, 164.
Black-throated Bunting, 634.
Black-throated Finch, 189.
Black-throated Green Warbler, 509.
Black Vulture, 498, 646.
Bladderwort, 375, 616.
Blister-beetles, 96, 99.
Bloodroot, 129.
Blowing of Whales, 333, 334.
Blowing Viper, 555.
Bluebird, 159, 202.
Bluebird's Eggs, variation of, 391.
Blue-gray Flycatcher, 202.
Blue Grosbeak, 478.
Blue-headed Greenlet, 478.
Blue Heron, 82, 231, 401.
Blue Jay, 384, 511.
Blue Linnet, 77, 479.
Boat-tailed Grackle, 636.
Bobolink, 78.
Bog-blutter, 170.
Bohemian Wax-wing, 473.
Bombycilla Carolinensis, 384.
Bombyx monacha, 378. B. pini, 378.
Bonasa Sabinii, 82, 209.
Book of Beasts, 46.
Book of Birds, 46.
Bopyrus, 45, 242. B. Hippolites, 243. B. squillarum, 243.
Boscanion flaviventris, 124. B. vetustus, 124.
Botanical Notes, 101, 382.
Botany of Central Illinois, 5.
Botaurus, 169. B. australis, 177. B. lentiginosus, 169, 177. B. limnophilax, 177. B. pœciloptila, 177. B. stellaris, 177.
Bothremys Cookii, 89.
Botrychium lanceolatum, 382. B. Virginicum, 381.
Bottom land of Colorado Valley, trees on the, 471.
Bottosaurus, 90.
Bourguetticrinus Hotesieri, 275.
Boyle's Milk Snake, 478.
Box-elder, 405.
Box Turtle in Winter, 279.
Brachiopoda, 441, 611.
Brachiopods, early stages of, 385.
Brachyramphus hypoleucus, 186.
Branchiate vertebrata, 606.
Branchipus, 501.
Brazilian Cuttle Fish, 259.
Breeding Habits of Birds, 48.
Breeding Habits of Salamanders and Frogs, 157.
Breeding of Rare Birds, 222.
Brewer's Sparrow, 77.
Bridled Tern, 340.
Brier, 163.
Brown Creeper, 428, 511.
Brown Thrush, 206, 473, 508.
Bryozoa, 214.
Bubo Virginianus, 570. B. Virginianus Atlanticus, 570. B. Virginianus Magellanicus, 570. B. Virginianus Pacificus, 570.
Buccinum undatum, 383.
Bucephala Islandica, 83.
Buckthorn, 212.
Bufo alvarius, 480. B. Columbiensis, 125.
Bulletin of the Essex Institute, 150.
Bullock's Oriole, 477.
Buntings, 298.
Burbolt, 17.
Burbot, 17.
Burial by Aborigines of Tennessee, 65.
Burrowing Owl, 100, 183, 475.
Bush-tailed Rat, 476.
Busycon, 285. B. canaliculatum, 286. B. carica, 286. B. gibbosum, 286. B. perversum, 354, 459, 464.
Butcher bird, 159.
Buteo borealis, 393. B. calurus, 184. B. Cooperii, 518. B. lineatus, 517. B. montanus, 295, 393. B. vulgaris, 397. B. zonocerus, 186.
Buthus ? 45.
Butter bump, 170.
Buttercups, 8.
Butterflies of New England, 148, 212.
Buttonwood, 185.
Buxbaumia aphylla, 329.
Bythinia tentaculata, 670.

Cabbage-palms, 352.
Cabinet-bug, 388.
Cactaceæ, 187, 283.
Cactus, 233, 283, 284. Cactus Wren, 183.
Caddis fly, 160.
Calamospiza, 78. C. bicolor, 296.
Calianassa, 243.
Calidris arenaria, 638.
California Hawk, 518.
Californian Opossum, 477.
California, the Naturalist in, 470.
Caligus, 241. C. Americanus, 241.
Calliactis, 247. C. bicolor, 247. C. tricolor, 247. C. variegata, 247.
Callinectes, 499.
Callinema ornata, 332.
Callista gigantea, 467. C. maculata, 467.
Callitriche, 219. C. verna, 212.
Calocystis cribraria, 216.
Calopogon pulchellus, 382.
Caltha palustris, 129.
Campylorhynchus brunneicapillus, 183.
Canace Canadensis, 636.
Canada balsam, 165.
Canada Goose, 83, 506.
Canada Jay, 80, 222, 384, 387.
Canadian Entomologist, 435.
Canerisocia expansa, 249.
Canis latrans, 184, 476.
Canker worm, 365.
Cantharidæ, 96.
Cantharis marginata, 96.
Canvas-Backed Duck, 639.
Cape-May Warbler, 578.
Caprella, 244.

Caprimulgidæ, 11.
Carabidæ, 168.
Caraboo, 548.
Carbolic acid, 168, 557.
Carcinas mænas, 435.
Cardamine rhomboidea, 130.
Cardinalis Virginianus, 605.
Cardinal Plant, 211.
Cardita borealis, 273, 277, 380.
Cardium, 236. C. isocardia, 468. C. magnum, 496. C. pinnulatum, 273.
Carduelis elegans, 635.
Carex Backii, 155. C. Houghtonii, 155. C. laxiflora. 155. C. lenticularis, 155. C. varia. 155.
Carinaria, 237.
Carolina Parrots, 465.
Carolina Rail, 231.
Carp, 297.
Carpinus, 438.
Carpiodes damalis, 297.
Carpodacus, 76. C. frontalis, 183. C. frontalis, nest of, 479. C. purpureus, 581.
Carvings, Natural, 427.
Carya, 438. C. tomentosa, 410.
Case worm, 160.
Cassia, 439, 502. C. Marilandica, 439.
Cassin's Kingfish, 184.
Castilleja sessiliflora, 163.
Catalpa, 400.
Cat Bird, 73, 295.
Catfish, 126, 297.
Cathartes atratus, 498, 646. C. aura, 107.
Catostomus, 126, 480.
Cattle Tick, 51, 52.
Cecil's Book of Insects, 46.
Cedar Bird, 34, 384.
Cedars of Lebanon, 102.
Cedarites, 641.
Celtis reticulata, 421, 407.
Cemoria Noachina, 270.
Centaurea dumulosa, 122.
Centipedes, 45, 164.
Centrocercus urophasianus, 82, 188.
Centronyx Bairdii, 513, 554, 631. C. Lapponicus, 631.
Centroplanes Lapponicus, 585.
Centroscymnus cœlolepis, 53.
Centurus Carolinus, 581. C. uropygidlis, 472.
Cephalopods, 441, 501, 661.
Cerasus Caroliniana, 463. C. mollis? 419, 498. C. Virginiana, 418.
Ceratophyllum demersum, 375.
Cereus sol, 247.
Cerf mullet, 180.
Cerianthus, 216.
Cerithidea scalariformis, 461.
Cermatia, 103.
Certhia Americana, 74, 296. C. Mexicana, 74.
Cervus auritus, 180. C. Columbianus, 186, 477. C. macrotis, 180. C. macrotus, 180. C. Mexicanus? 186. C. Virginianus, 180, 401, 522, 549.
Cestoidea, 218.
Chætopodous worms, 214.
Chætopterus pergamentaceus, 246.
Chætura, 296.
Chama arcinella, 467.
Chamæa fasciata, 185.
Chamærops palmetto, 352. C. serrulata, 283, 400.
Chamœpelia passerina, 282.
Chapter on Cuttle Fishes, 257.
Chareæ, 219.
Chat, 295.
Cheese Mite, 372.
Chelonia, 609.
Chelydrine Emydes, 88.
Chelytus, 368, 373.
Chenopodium album, 97.
Chenopodiums, 358.
Chestnut colored Bunting, 76.
Chestoles lapidea, 46.
Chiasmodon niger, 53.
Chicago Academy of Sciences, 557.
Chicago Microscopic Club, 111.
Chickadee, 299, 429.
Chigoe, 386.
Chilognatha, 104.
Chilopoda, 104.
Chilopsis linearis, 189.
Chimæra, 229.
Chimney Swallow, 8, 12.
Chinch Bug, 96, 355.
Chinchilla, 444.
Chionobas semidea, 331.
Chipping Sparrow, 77, 292, 473, 508, 582, 634.
Chironectes, 107.
Chiton, 270. C. albus, 272.
Chloride of Soda solution, 166.
Choke cherry, 406.
Chondestes grammaca, 77, 295.
Chordeiles Henryi, 297. C. Texensis, 186, 477.
Chroccephalus atricilla, 641.
Chrysemys picta, 555.
Chrysomitris Lawrencii, 185. C. pinus, 76, 510, 582. C. tristis, 76.
Chrysophanus Americanus, 212, 330. C. Epixanthe, 330. C. Thoe, 330.
Chrysosplenium Americanum, 129.
Churchill's Bull-snake, 478.
Cmoliasaurus magnus, 87.
Cinnamomum, 41.
Cirsum muticum, 382.
Cistudo Virginica, 279.
Citrus decumana, 400.
Clam, Anatomy of, 24, 25.
Clams, Salt and Fresh-water, 21.
Clapper-rail, 48, 600.
Clarke's Crow, 298.
Clarke's Nutcracker, 79.
Classification of Animals, Huxley's, 543, 607.
Clavella, 241.
Clay-colored Sparrow, 299.
Claytonia Virginica, 130.
Cleridæ, 168.
Clidastes, 85. C. iguanavus, 86.
Cliff Swallow, 33, 228.
Climbing Perch, 107.
Closterium, 314, 317, 319, 322, 323.
Clytus pictus, 168.
Coast Fox, 186.
Coccinellæ, 95.
Coccinella 9-notata, 94.
Coccoliths, 108, 655.
Coccoloba platyclados, 672.
Coccospheres, 108, 655.
Coccus cacti, 233.
Coccygus Americanus, 570.
Cochineal, 233.
Cockles, 286.
Cockroach, 46.
Codakia tigerina, 499, 500.
Codfish, 17.
Cœlenterata, 543
Coffee-shell, 403.
Colaptes, 296. C. auratus, 296, 390, 425. C. chrysoides, 474. C. Mexicanus, 183.

Coleoptera, 213, 379.
Colias Philodice, 212, 330.
Collensea verna, 8.
Collyrio borealis, 34, 35. C. elegans, 34, 580. C. excubitoroides? 34, 295, 580. C. Ludovicianus, 159, 579.
Colorado beetle, 91, 92, 93.
Colorado Valley, climate of, 471.
Colpadium Malmgreni, 215.
Colpophyllia, 500.
Columba fasciata, 80, 185.
Comatula, 276.
Common Bittern, 231.
Common Crossbill, 384.
Common Gallinule, 639.
Common Sage, 357.
Common Sora, 231.
Common Tern, 641.
Common Turkey, Senses of Sight and Smell of, 28.
Compositæ, 6.
Compressed Burbot or Eel-Pout, 17.
Compression as an agent in Geological Metamorphism, 501.
Comptonia asplenifolia, 120.
Concholepas, 251.
Conchs, 285.
Cone-flower, 8.
Conifera, 438.
Coniferæ, 350.
Confervæ, 131, 165.
Connecticut warbler, 574.
Contopus Richardsonii, 31, 480.
Contraband Hawk, 186.
Conurus Carolinensis, 465.
Coots, 226, 234, 235.
Copperhead, 158.
Coppery Whipsnake, 187, 478.
Corallina officinalis, 131.
Corallium rubrum, 352.
Corals, 43, 300.
Corals and Polyps, 612.
Coral Snakes, 39, 278, 497.
Corbicula, 447.
Coregonus, 126, 297.
Corema Conradi, 327.
Corixa, 491.
Cormorants, 234.
Cornus pubescens, 419, 407.
Corophium, 434.
Corrosive sublimate, 307.
Corvus Americanus, 79, 384. C. Canadensis, 384. C. carnivorus, 79, 183. C. caurinus, 79. C. cristatus, 384. C. ossifragus, 287.
Corylus, 438.
Corylus rostrata, 130.
Corythus enucleator, 384.
Cosmarium, 323.
Cotalpa lanigera, 49, 50.
Cotoneaster, 122.
Cottoid, 126.
Cotton-boll Worm, 168.
Cotton Wood, 408.
Coturniculus Henslowii, 632. C. passerinus, 507.
Cotyle riparia, 474.
Couch's Gartersnake, 187.
Couguar, 186.
Cow-bird, 291, 292, 293.
Cow Blackbird, 291, 293, 294.
Cow Bunting, 78, 292, 550, 576.
Cow devouring the Placenta, 555.
Cowslip, 129.
Coyote, 184, 476.
Crabs, 240, 247, 261.
Crabs, hearing of, 278.
Crabs, Metamorphosis of, 432.
Crane-flies of North America, 151.
Crataegus rivularis, 406, 419, 420, 421. C. sanguinaria? 407, 419, 421.
Craxirex unicinctus, 481.
Creeper, 74, 192.
Crenella, 383. C. glandula, 273.
Cretaceous Formation, 415.
Cretaceous turtles, 88.
Crinoid, 275, 496, 501.
Cristatella, 441.
Crocodiles, 87, 90.
Crocodiles and Lizards in general, How to skin and mount, 482.
Crocodilia, 609.
Crotalus atrox, 475. C. confluentus, 124, 298. C. Hallowelli, 187. C. Lucifer, 124.
Crotaphytus, 478.
Crow, 228.
Crow, a bird of prey, 102.
Crow Blackbird, 291, 294.
Crustacea, 240, 433, 543.
Crustaceans, 43.
Crustacea, Parasitic habits of, 239.
Cryptogams, 440.
Cryptogamma acrostichoides, 440.
Cryptops, 104.
Curlew, 225, 298.
Curvirostra Americana, 299, 583. C. Americana Mexicana, 76. C. leucoptera, 76, 584, 585.
Cuttle fish, 236, 237, 257, 260.
Cyamus, 244.
Cyanea, 243. C. arctica, 332.
Cyanospiza amœna, 77, 479.
Cyanura Stellerii, 80.
Cyatholithus, 655.
Cyathophylloid corals, 216.
Cyclas dubium, 159.
Cyclops, 241, 433.
Cygnus Americanus, 83, 473.
Cylichna alba, 273.
Cymothoa, 242, 244.
Cynomys Ludovicianus, 298.
Cynthia Lavinia, 280.
Cyperaceæ, 6, 439.
Cypræa annulus, 4. C. moneta, 5.
Cypress, 456.
Cyprinoid, 53, 126, 297.
Cypripedium candidum, 6. C. pubescens, 8.
Cypris, 241, 433.
Cypselus pelasgius, 12.
Cyrena Carolinensis, 401.
Cystideæ, 216, 495.
Cystiphyllum, 216.

Dactylochalix pumicea, 451.
Daddy-long-legs, 46.
Dadoxylon Sandstone, 442.
Dalea, 359.
Danais Erippus, 330.
Daphne olæoides, 122.
Dark Woodmouse, 476.
Date Palm, 111, 300.
Decapods, 240, 499, 612.
Deep Sea Dredging, 53, 108, 614.
Deer, 186.
Delphinium anthoroides, 122.
Demigretti Pealii, 401. D. rufa, 401.
Demodex folliculorum, 372.
Dendrocygna fulva, 475.
Dendroeca Blackburniæ, 577. D. castanea, 578. D. discolor, 507, 578. D. verens, 509. Dendroica Audubonii, 33. D. æstiva, 296.

Dentalium pretiosum, 3. D. striolatum, 273.
Dermaleichus pici-pubescentis, 493.
Dermestes, 388.
Desmid, 166, 314, 315, 317, 321, 322.
Desmidiaceæ, 313, 316.
Desmidiæ, 165, 166, 316.
Desmidium, 323. D. Swartzii, 166.
Desmognathus fuscus, 158.
Destructiveness of the Larva of the Goldsmith Beetle, 49.
Development of Insects, 490.
Development of Phryganidan Eggs, 490.
Devil-fish, 261.
Devonian Slates, 442.
Diatomaceæ, 165, 166, 215, 432.
Diatoms, 316, 317, 318, 661.
Diatoms, Type-plate of, 222.
Dicentria Canadensis, 7, D. cucullaria, 7.
Dicynodontia, 609.
Didelphia, 607.
Diemictylus viridescens, 158.
Dinosaurs, 84, 609.
Diogenes Edwardsii, 248.
Dipioria, 500.
Diplostomum, 42.
Dipnoi, 609, 610.
Dipodomys agilis, 183. D. Phillippii, 477.
Dipsosaurus dorsalis, 478.
Diptera, Embryology and Anatomy of, 490.
Dirca palustris, 130.
Dirt-daubers, 391.
Discolithus, 655.
Discophora, 279.
Discovery of Remains of the Horse in the Ancient Ruins of Central America, 503.
Distorted Pebbles in Conglomerates, 501.
Distribution of Coal, Iron, etc, in China, 440.
Distribution of Forest Trees, 414.
Distribution of the Native Tribes of Alaska, 430.
Doe with Horns, 279, 548.
Dog-fishes, 285.
Dog Salmon, 127.
Dog, the Esquimaux, 523.
Dolichonyx oryzivorus, 78.
Doliosaurus platyrhinos, 475.
Dolphins, 90.
Domecia hispida, 247.
Doridicola, 242.
Dorippe, 249.
Doris pilosa, 241.
Doryphora 10-lineata, 91, 92, 93.
Dosinia discus, 287.
Doto coronata, 241.
Double Early Saxifrage, 329.
Double Flowered Sarracenia, 48.
Double Thalictrum Anemonoides, 382.
Dove, 81, 295.
Downy Woodpecker, 384, 424, 511.
Dragon-fly, Development of, 491.
Dredge, Description of, 269, 270.
Driver Ants, Habits of, 360, 364.
Dromidia Antillensis, 248.
Drosera rotundifolia, 211.
Drymobius testaceus, 187.
Dryocampa rubicunda, 95.
Duck Hawk, 514.
Duckweed, 376.
Dugong, 444.
Dusky Duck, 233.
Dusky Grouse, 81, 298.
Dytiscus, 369.

Earthworms, Habits of, 388.
East Indian Archipelago, Travels in, 39.
Echidna, 607.
Echinacea, 8.
Echinocucumus typica, 666.
Echinodermata, 543.
Echinoderms, 43, 108, 499.
Echinoids, 612.
Echinus, 43, 285.
Ectopistes migratoria, 80, 295.
Eel, 107, 489.
Eel-pout, 18.
Eggs of Great Auk, 550.
Egret, 401, 510.
Eider Duck, 233.
Elaps, 112, 497. E? euryxanthus, 36, 278.
Elasmobranchii, 609, 610.
Elasmosaurs, 86.
Elasmosaurus, 91. E. orientalis, 87. E. platyurus, 87.
Eleocharis olivacea, 448.
Elephant mounted, 145, 146.
Ellisia nyctelæa, 163.
Emerald, 303.
Empetrum Conradi, 327.
Empidonax, 230, 295, 477. E. Acadicus, 230. E. flaviventris, 230, 504, 572. E. Hammondii, 479. E. minimus, 31, 572. E. obscurus, 31, 477. E. pusillus, 31, 295, 479. E. Traillii, 479.
Emydes, 88.
Emydiform turtles, 88.
Enchodi, 87.
Encope emarginata, 663.
Endogens, 566, 567.
English Marsh Marigold, 129.
Enteromorpha intestinalis, 265. [307.
Entomological Cabinets, preservation of,
Entomology, American, Record of, 378.
Entomostraca, 156, 161, 240, 241, 383, 433.
Eocene, 444.
Eolis ruffibranchialis, 241.
Eophyton Linnæanum, 56.
Eozöon, 55; in Essex County, 498.
Epeira cancer, 616. E. riparia, 616. E. vulgaris, 616.
Epigæa repens, 123.
Epilobium angustifolium, 669. [560.
Epiphegus Americana, 560. E. Virginiana,
Equus conversidens, 392. E. curvidens, 392. E. parvulus, 445. E. Tau, 392.
Eremophila alpestris, 581. E. cornuta, 75, 295, 297.
Ereuntes pusillus, 638.
Ericaceæ, 6.
Erioganum, 359.
Erythrolamprus, 497.
Erythronium, 8.
Eschrichtius robustus, 217.
Esox, 126, 297.
Esquimaux Curlew, 83. E. dog, 523.
Essex County, the Eozöon in, 498.
Essex Institute, Bulletin of, 150.
Euclastes platyops, 89.
Eudamus Bathyllus, 331. E. Lycidas, 331. E. Tityrus, 331.
Euglenia, 316.
Eugorgia, 500.
Eunicea, 500. [248.
Eupagurus Prideauxii, 247. E. pubescens,
Eupatoriums, 8.
Euphorberia, 45.
Eupigium, 122.
Euplectella, 654. E. aspergillum, 453. E. speciosa, 451.
Euproops Danæ, 45.
Eupsammidæ?, 216, 612.

European Cuckoo, 292.
European Goldfinch, 635.
European House Sparrow, 635.
Euryechinus imbecillus, 246.
Eurynome tenuicornis, 220.
Eurypterus, 44, 45.
Euschistus punctipes, 98.
Euspiza Americana, 634.
Eustrongylus papillosus, 42.
Eutainia Couchii, 187. E. vagrans, 124.
Evening Grosbeak, 75.
Evolution of Spiders, 490.
Exogen, 566, 557.
Exogyra, 88.
Extinct Flora of North America, 40.
Eye, structure of, 305,

Fabia Chilensis, 246.
Fairy purses, 285.
Fagus sylvestris, 218.
Falco anatum, 514. F. borealis, 384. F. buteo, 397. F. candicans, 513. F. Islandicus, 513, 514. F. Leverianus, 397. F. nigriceps, 514. F. peregrinus, 514. F. sacer, 513. F. sparverius, 516.
Fan Mussels, 284.
Fasciolaria, 354. F. distans, 466. F. gigantea, 354, 464. F. tulipa, 466.
Fauna of Montana Territory, 31, 73, 124.
Fauna of the Gulf Stream at great Depths, 43.
Felis concolor, 186, 465. F. eyra?, 186.
Fence Lizard, 478.
Fenestrella, 616.
Fever-bush, 130.
Fiddler-crab, 587.
Field Plover, 53, 298.
Filaria, 42.
Finches, 229.
Finner Whale, 334.
Fire Bird, 37?
Firs, 185.
Fish Crow, 287.
Fish Culture, 202, 325.
Fish, Deformities of, 289, 290.
Fish, Development from egg, 288, 289.
Fishes, 215, 483, 609.
Fish Hawk, 227, 569.
Fissurella, 252, 253.
Flight of Birds, 107.
Flints, 318.
Floral Organs, tendency to exchange offices, 494.
Flora of Palestine and Syria, 121.
Florida, Agriculture of, 469.
Florida and the South, 494.
Florida, Climate of, 469.
Florida cærulea, 401, 511, 637.
Florida Gallinule, 231.
Florida Oranges, 400.
Florida, Rambles in, 281, 349, 397, 455.
Flounders, 217.
Flowers of Early Spring, 128.
Flowering of Posoqueria, 380.
Flycatchers, 31.
Flyhouse, 550.
Fontaria Virginiensis, 104.
Fontinalis antipyretica, 376.
Foraminifera, 43, 333, 661.
Forest Trees, Distribution of, 414. Insects Injurious to, 214.
Forked-tailed Flycatcher, 477.
Fossil Crinoids, 305, 666.
Fossil Insects, 44.
Fossil Jelly Fishes, 279.
Fossil Plants, 41, 215.
Fossil Plants from Greenland, 55.
Fossil Reptiles of New Jersey, 84.
Fossil Rhinoceros, 55.
Fossil Tubularian, 616.
Fragaria Gillmani, 221, 328. F. Illinoensis, 328. F. Indica, 328. F. semperflorens, 328. F. vesca, 328, 329, 669. F. Virginiana, 329, 381.
Fragillaria, 166.
Frangula Caroliniana, 400. F. Purshiana, 407, 419.
Franklin's Grouse, 81.
Fraxinus Oregona, 407.
Fredericella, 385.
Fresh-water Aquarium, 131, 207, 373, 486.
Fresh-water Clam, 26, 27.
Fresh-water Mussel, 369.
Fresh-water Newts, 374.
Fresh-water Plants, 211.
Fresh-water Shells, 530.
Fringilla Hudsonica, 384.
Frogs, 629.
Frog's bit, 376.
Fulmar, 235.
Fulmar Petrel, 235.

Galium, 448.
Gallinula galeata, 639. G. Martinica, 498.
Gallinula, 511.
Gamasus, 493.
Gambel's Finch, 183.
Gambel's Quail, 474.
Gambel's Woodmouse, 476.
Gambetta melanoleuca, 83.
Ganoidei, 610.
Gare-fowl, 539.
Garzetta candidissima, 637.
Gasteropoda, 247, 251.
Geese, 182.
Gemmaria Americana, 248.
Genera, Origin of, 147.
Gentians, 8.
Geococcyx Californianus, 477.
Geodia, Spiculæ of, 451.
Geological Survey of Illinois, 44.
Geology of Alaska, 658.
Geology of N. E. America, 442.
Geomys pinetus, 457.
Geophila, 251.
Geophilus bipuncticeps, 104.
Geothlypis Macgillivrayi, 32, 299, 477. G. trichas, 296.
Geradia, 8.
Geranium maculatum, 48.
Gerfalcon, 513.
Gerrhonotus, 187.
Gerrhonotus olivaceus, 187. G. Webbii, 187.
Giant-kettles, 217.
Gila robusta? 480.
Gila Woodpecker, 472.
Giraud Cabinet, 539.
Glacial Phenomena, 218.
Glandina rosea, 403. G. truncata, 403.
Glass Sponge, 53.
Glassy Nautilus, 237.
Glaucoma, 110.
Gleditschia, 439.
Globbigerna bulloides, 655.
Globiceps, 53.
Globigerinæ, 43, 108.
Glomeridæ, 103, 104.
Glossy Ibis, 637.
Glyceria, 155.
Glycerine for preserving natural colors of Marine animals, 156.

Glyptodon, 392.
Gnat Catcher, 184.
Godwit, 225.
Golden Crowned Thrush, 292.
Golden Crowned Wren, 32, 97.
Golden Eagle, 568.
Golden-eyed Duck, 384.
Golden Plover, 231.
Golden-rods, 8, 97.
Golden Saxifrage, 129.
Golden-tail, 37.
Golden-winged Warbler, 497, 515.
Golden-winged Woodpecker, 390, 422.
Golden-winged Woodpecker, Habits of, 422.
Goldsmith Beetle, Larva of, 49.
Gomphonema, 196.
Gophers, 183, 457, 477.
Goshawk, 222, 387, 397, 516.
Graham's Salvadora, 478.
Grallatores, 401.
Gramineæ, 6, 155.
Grantia nivea, Spiculæ of, 451.
Grape Sugar, 216.
Graptolitha, 336.
Grapta C-argenteum, 331. G. comma, 331. G. Faunus, 331. G. gracilis, 331. G. interrogationis, 331.
Grasses, 6, 212.
Grass Finch, 472.
Grasshoppers, North American, Catalogue of, 47.
Grasshoppers, Swarms of, 163.
Gray Crane, 82.
Gray Kingbird, 645.
Gray Owl, 334, 335.
Gray Squirrel, 186.
Grease-wood, 358.
Great Auk, 384, 539, 550, 644.
Great Blue Crane, 401.
Great-crested Flycatcher, 581.
Great-eared Deer, 180.
Great-footed Falcon, 228.
Great Gray Owl, 570.
Great Hen Hawk, 397.
Great Horned Owl, 570.
Great White Heron, 637.
Green Alder, 408.
Green Dogwood, 407.
Green Heron, 231.
Green Racer, 124.
Green-winged Teal, 83.
Gregarinida, 428, 429.
Grizzly Bear, 186.
Ground Cuckoo, 477.
Ground Dove, 282, 481.
Ground Hog, 390.
Ground Squirrels, 182.
Grunter, 297.
Grus Americanus, 401. G. Canadensis, 32.
Gryllotalpa, 151. G. australis, 151.
Guano, 150.
Guarani Tongue, 503.
Guillemots, 345.
Guiraca cœrulea, 478. G. melanocephala, 295.
Gulf-stream, Fauna of, 43.
Gulls, 226.
Gymnocladus, 439.
Gymnophiona, 609.
Gyrencephala, 608.
Gyrostomum urciolatum, 336.

Hadrosauri, 91.
Hairy Woodpecker, 384, 511.
Halcyonoid Polyps, 500.
Halichondria Griffithii, spiculæ of, 451.
Haliotis Californiensis, 256. H. corrugata, 256. H. Cracherodii, 252, 254, 256. H. Iris, 254. H. Kamachatkana, 256. H. rufescens, 4, 252, 254, 255, 256. H. splendens, 255. H. tuberculata, 254, 256, 555.
Haliplana fulginosa, 644.
Hallowell's Rattlesnake, 187.
Hammond's and Traill's Flycatcher, 479.
Hare, a new species of, from the summit of Wind River Mountains, 113.
Hares, 183, 184.
Harpactor cinctus, 98.
Harpalocarcinus marsupialis, 246.
Harporhynchus crissalis, 473. H. Lecontei, 188, 473. H. redivivus, 188. H. rufus, 296, 508.
Harris Squirrel, 188.
Harvest-man, 46, 365, 369.
Hawk Owl, 569.
Hawk, red-tailed, 393.
Hazel nut, 130.
Hearing of Crabs, 278.
Heath, 6.
Hecto-cotylus, 237.
Helianthus, 8.
Helicina orbiculata, 460.
Helicopsyche, 160, 161. H. Ceylonica, 160. H. glabra, 160.
Helix cereolus, 468. H. uvuligera, 468. H. volvoxis, 403, 460.
Helminthophaga celata, 476. H. chrysoptera, 575. H. Luciæ, 476. H. peregrina, 575.
Helmitherus Swainsonii, 576. H. vermivorus, 556, 576.
Hemiptera, 215. Embryology of, 491.
Hemlock, 130.
Hemlock Spruce, 412.
Hen-hawk, 393, 397.
Henslow's Sparrow, 632.
Hepatella, 250. H. amica, 250.
Hepatica, 129.
Hepatus, 250.
Heptanchus, 627.
Hermit Crabs, 247, 248, 265.
Hermit Thrush, 573.
Herodias egretta, 401, 637.
Herons, 230.
Herring Gulls, 234, 512, 640.
Hesperia Acanootus, 331. H. Ahaton, 331. H. Delaware, 331. H. Egeremet, 331. H. Hianna, 331. H. Hobomok, 331. H. Leonardus, 331. H. Logan, 331. H. Manataaqua, 331. H. Manoco, 331. H. Massasoit, 212, 331. H. Mesapano, 331. H. Metacomet, 331. H. Metea, 212, 331. H. Mystic, 331. H. Oneko, 331. H. Panoquin, 331. H. Pocahontas, 212, 331. H. Quadaquina, 212, 331. H. Samoset, 331. H. Sassacus, 331. H. Verna, 331. H. Vialis, 331. H. Wamsutta, 331. H. Wingina, 331.
Hesperian Region, 414.
Hesperiphona vespertina, 75.
Hesperomys austerus? 476. H. Gambelli, 473. H. Sonoriensis, 183.
Heterodon platyrhinus, 585.
Heteronereis, 494.
Heteropterus marginatus, 331. H. ventricosus, 372, 373.
Hexanchus, 627.
Hierochloa borealis, 155.
Himantopus nigricollis, 638.
Hints on Taxidermy, 136, 189, 481.
Hipparchia Boisduvalii, 331.
Hippodamia, 13. H. punctata, 94.
Hippolyte, 243. H. Sowerbyi, 243.

Hirundineæ. 220.
Hirundo bicolor, 33, 116, 474. H. horreorum, 33. H. lunifrons, 33. H. riparia, 116. H. rustica, 12. H. Thalassina? 33.
Hive Bees devoured by Hornets, 52.
Holothuria edulis, 497.
Holothurians, 500.
Holy Grass, 155.
Honey-bee, 40.
Honey-bee killed by Asclepias pollen, 388.
Honey-bees killed by pollen, 109.
Honey-bees, substitute for Pollen, 52.
Hooded Oriole, 186.
Horned Lark, 75, 183, 581.
Horns, Does with, 548.
Horned Lizard, 475.
Horned Toad, 124, 298.
Hornemann, Analysis of Sponges, 451.
Hornets, Hive-bees devoured by, 52.
Hornstones, 318.
Hornwort, 375.
Horse Conch, 464.
Horseshoe Crab, 240.
House Finch, 184, 582.
House Finch, nest of, 479.
House fly, 550.
House Wren, 49, 390, 614.
Houstonia, 129. H. cærulea, 7. H. purpurea, 7.
Humming Birds, 192, 475.
Hump-back Whale, 334.
Hunterius Swedenborgii, 217.
Hyalonema boreale, 246. H. Lusitanicum, 53.
Hydrachna, 369. H. concharum, 369.
Hydractnia, 256. H. polyclina, 248.
Hydraspididæ, 88.
Hydrax, 608.
Hydrotata Mexicana, 32.
Hydrobatidæ, 215.
Hydrochelidon fissipes, 644.
Hydroids, 244, 248.
Hydromedusa, 90.
Hydrometra, 369, 491.
Hydrozoa, 616.
Hylotomus pileatus, 572.
Hyoden tergisus, 126.
Hyperia, 243.
Hypoconcha arcuata, 249. H. Panamensis, 249.
Hypocrepian Polyzoa, 441.
Hyponome Sarsi, 495.
Hypopus, 495.
Hyppolite, 155.

Ibis Ordii, 637.
Ichthyopsida, 607, 609.
Ichthyosauria, 609.
Icteria viridis, 295, 477.
Icterus Baltimore, 509. I. Bullockii, 477. I. cucullatus, 186.
Idalia aspera, 241.
Idols, 72.
Illinois, Fossil Insects in, 45.
Illinois, Geological Survey of, 44.
Inca Bird, 37.
Indian Bean, 400.
Indian Pipestem, 6.
Indian relics, 168.
Indigo bird, 292.
Infusoria, 543.
Insect Boxes, 56, 111.
Insect Parasites, 214.
Insects, Development of, 490.
Insects, Guide to the Study of, 161, 379.
Insects injurious to Forest Trees, 214, 377.
Insects Injurious to the Potato, 91.
Itch Insect, 372.
Ixodes albipictus, 365, 366. I. bovis, 370, 373. I. unipunctata, 370, 373.

Jaguar, 186.
Japanese Glass-ropes, 216.
Jeffersonia diphylla, 129.
Jelly-fishes, 243.
Jigger, 386.
Jone thoracicus, 243.
Julus, 103, 104. J. multistriatus, 103.
Jumping Deer, 180.
Jumping mice, 183.
Juncus, 219.
Junco hyemalis, 510. J. Oregonus, 77, 473.
Juniper, 187, 412.
Juniperus communis, 413, 415. J. occidentalis, 187. J. Virginiana, 130, 413, 415, 459.

Kalmia, 7.
Kansas, plains of, 162.
Keratoisis Grayii, 55.
Keronæ, 110.
Kill-deer, 182, 231, 340.
King bird, 309, 390.
Kingfisher, 48, 149, 170, 389, 615.
Kjœkkenmœddings, 54, 286, 336.
Kœleria cristata, 155.
Kootenay region, 417.

Labrador Duck, 383.
Labradorite, 442.
Labarinthodonta, 609.
Lace Lizards, 85.
Lacertilia, 609.
Lactophrys camelinus, 467.
Ladder Woodpecker, 474.
Lady bird, 93, 98.
Lælaps aquilunguis, 91.
Læmargus, 630.
Lagopus albus, 637. L. leucurus, 82.
Lake Superior plants compared with Eastern specimens, 155.
Lamellibranchiata, 611.
Laminaria digitata, 621.
Laminarian algæ, 218.
Lamprey eel, 20.
Lampreys, 501.
Lampropeltis Boylii, 478.
Land Tortoise, 478.
Lanivireo solitarius, 507, 579.
Lanius elegans, 579. L. excubitoroides, 476, 579.
Lapland Longspur, 585.
Larger White Eyret, 234.
Large Savannah Sparrow, 76.
Laridæ, 235.
Larix Americana, 413. L. occidentalis, 412, 419, 420.
Lark Bunting, 296.
Lark Finch, 77, 295.
Larrea Mexicana, 471.
Larus argentatus, 512, 516, 640. L. Smithsonianus, 640.
Lathyrus ochroleucus, 156.
Laughing Gull, 641.
Laurentian Eozoon, 662.
Lawrence's Goldfinch, 185.
Laws governing the sexes of plants, 438.
Leach's Petrel, 235,
Lead-colored Gnatcatcher, 474.
Leafed-nosed Bat, 472.
Leaf-rolling moth, 336.
Least Bittern, 231.
Least Tern, 234, 338.

Leather wood, 130.
Lecanium, 491.
Leconte's Mock Thrush, 188.
Leguminosæ, 122, 163.
Lemna trisulca, 376.
Lemurs, 501.
Leptoptera of North America, List of, 46.
Lepidopterist's Guide, 379.
Lepidosirens, 501, 609.
Leptophis, 159.
Lepus artemisiæ, 476. L. Audubonii, 183. L. Bairdii, 115. L. Californicus, 183, 470. L. callotis, 359, 470. L. campestris, 115. L. glacialis, 115. L. sylvaticus, 115.
Lernea, 241.
Leskia mirabilis, 216.
Lesser Redpoll, 384.
Levant Sponge, spiculæ of, 451.
Lewis' Trout, 125.
Lewis' Woodpecker, 298.
Liatris, 8.
Libellulidæ, development of, 491.
Libinia, 261, 265. L. canaliculata, 264.
Lichen, 336.
Lilies of the Fields, of the Rocks and of the Clouds, 289, 305, 553.
Limacidæ, 220.
Limbs, Regeneration of, 390.
Limenitis Arthemis, 330. L. Misippus, 330. L. Proserpina, 330. L. Ursula, 330.
Limnæa bulimoides, 297, 447. L. desidiosa, 297, 417. L. limosa, 220. L. palustris, 297, 417.
Limnocharis Humboldtii, 376.
Limnophilus subpunctulatus, 161.
Limulinus paradoxus, 213.
Limulus, 240.
Linaria minor, 384.
Lincoln's Finch, 78.
Lincoln's Sparrow, 581, 634.
Lingula, 385. L. albida, 109.
Linosyris, 359.
Lionsia hyalina, 272.
Liquid poison for insect boxes, 308.
Lissencephala, 608.
Lithobius Americanus, 104.
Lithodomus, 245.
Litigorgia, 500.
Littorina obesa, 4.
Little Blue Heron, 510, 637.
Little Flycatcher, 478.
Little Hermit, 266, 267.
Little Vireo, 186, 188. [461.
Littorina angulifera, 461. L. irrorata, 359,
Live Oak, 184.
Living Fish, Transportation of, 53.
Livoneca, 242.
Lizards, 298.
Lobelia cardinalis, 211.
Lobster, 218, 240.
Locust, 97.
Log Cock, 572.
Loggerhead Shrike, 159, 579.
Long-billed Nuthatch, 74.
Long-billed Sparrow, 186.
Long-billed Water Thrush, 577.
Long-eared Owls' eggs, 48.
Long-legged Tree Duck, 475.
Long-tailed Mocking-bird, 186.
Lonicera cœrulea, 672. [474.
Lophortyx Californicus, 183. L. Gambellii,
Lota compressa, 17, 18, 20. L. inornata, 18. L. maculosa, 18, 20.
Loxia curvirostra, 384. L. leucoptera, 384.
Loxosonia, 441.
Lucy's Warbler, 476.
Lupa dicantha, 272.
Lycæna Comyntas, 212, 330. L. Lucia, 212, 330. L. neglecta, 330.
Lycaretus, 215.
Lycosa Spider and its Young, 50.
Lyencephala, 608.
Lymnæa appressa, 651. L. columella, 651. L. decollata, 651. L. desidiosa, 651. L. elodes, 651. L. gracilis, 651. L. megasoma, 651. L. proxima, 651. L. reflexa, 651.
Lynx rufus, 183, 477.
Lytoloma angusta, 89. [96.
Lytta cinerea, 96. L. murina, 96. L. vittata,

Macgillivray's Warbler, 32, 299, 477.
Macrauchenia, 392.
Macrosaurus, 86. M. platyspondylus, 446. M. validus, 86.
Macrotus Californicus, 472.
Madrepora, 43, 247, 352, 500.
Mæandrina, 352, 500.
Magnolia glauca, 400.
Magpies, 297.
Mahoning Sandstone, 44.
Maia squinado, 265.
Mala nasus, 218.
Malherbe's Flicker, 474.
Mallard, 83, 506.
Malleus, 625.
Malmo Carolina, 220.
Malva Papaver, 162.
Mammilaria macromeris, 164.
Manatee, 43.
Manicina, 500.
Many-banded Robber, 98.
Maple-seed, three-winged, 613.
Maple Worm, 95.
Margarita cinerea, 273. M. undulata, 273.
Margaritana galeata, 297, 417. M. margaritifera, 297.
Margaritophora fimbriata, 245.
Marmot, 100, 299.
Marsh Rabbit, 343.
Marsipobranchii, 609, 610.
Marsupial Dogs, 53.
Marsupials [illegible] 607.
Marsupialia, 501.
Marteusia Virginica, 7.
Maryland Marmot, 390,
Maryland Yellow throat, 292, 576.
Massachusetts, birds of, 505, 512.
Masticophis testaceus, 478.
Mastigobrium trilobatum, 503.
Mastodon, 392.
May flower, 128.
Mazonia Woodiana, 45.
Meadow Lark, 183, 473.
Mealy Red-poll, 583.
Megatherium, 392.
Megerlia, 385.
Melampus coffea, 403, 461.
Melanerpes torquatus, 298.
Melania, 447.
Melantho coarctata, 535. M. decisa, 532, 533. M. integra, 535. M. ponderosa, 534.
Meleagrina margaritifera, 251.
Meleagris gallo-pavo, 456.
Melitæa Harrisii, 330. M. Nycteis, 330. M. Phaeton, 330. M. Tharos, 330.
Mellita hexapora, 663. M. testudinata, 663.
Meloe angusticollis, 96.
Melongena corona, 460, 464.
Melospiza gallax, 474, 479. M. Heermannii, 183. M. Lincolnii, 581, 634. M. melodia, 507. M. palustris, 507, 634. M. rufino, 77.

Menobranchus, 628.
Mephitis bicolor, 186. M. occidentalis, 186.
Mercenaria Mortoni, 354, 464.
Merganser, 506.
Mergus Americanus, 84. M. serrator, 84.
Merten's Spruce, 412.
Metamorphosis of crabs, 432.
Mexican Ever-bearing Strawberry, 221.
Mexican Flycatcher, 473, 475.
Mexican Woodrat, 476.
Miamia Danæ, 46.
Micrathene Whitneyi, 478.
Micropalama himantopus, 639.
Microscope, Thousand Objects of, 101.
Millepora, 500.
Milvulus forficatus? 477.
Mimosa scandens, 671.
Mimus caudatus, 186. M. Carolinensis, 73, 295. M. polyglottus, 282, 574.
Miocene, 444.
Mire-drum, 170.
Mississippi Valley, 325, 326.
Missouri Herring, 126.
Missouri Jackass Rabbit, 115.
Missouri Sucker, 126.
Mitchella repens, 381.
Mites, 364, 491.
Mniotilta varia, 509.
Mocking birds, 282, 574.
Modiola plicatula, 469.
Modiolaria discors, 383. M. lævigata, 243.
Mola nasus, 218. M. Retzii, 218.
Mole Crickets, 151.
Molecular Origin of Infusoria, 110.
Mollusca, 103, 240, 250, 272, 441, 491, 501, 543, 610, 611.
Molothrus pecoris, 78, 291, 474.
Momoti, 37.
Monera, 661.
Money cowry, 5.
Monodelphia, 607, 608.
Monotropa uniflora, 6.
Monstrosities among Trout, 288.
Montana, Fauna of, 31, 124. Sylva of, 405.
Montipora, 500.
Moose, 553.
Moose tick, 167.
Mosasauroids, 90.
Mosasaurus, 84, 85, 91. M. Copeanus, 446. M. maximus, 86. M. Missouriensis, 86. M. Mitchellii, 86.
Mosses, 211, 218.
Mother Carey's Chickens, 234.
Mother of pearl, 250, 251.
Moths, 168.
Mottled Owl, 334, 384, 424.
Mound builders of Tennessee, 60.
Mountain Plover, 82, 183, 298.
Mountain Quail, 185.
Mountain Rice, 155.
Mountain Sheep, 186, 296.
Mountain Titmouse, 75.
Mouse, a singing, 551.
Mud-wasp and Spider, 391.
Mugil, 401.
Mule Deer, 180.
Mullet, 401.
Murex, 356. M. rufus, 356.
Muricea, 500.
Mus leucopus, 120.
Mushrooms, 219.
Musschea pallescens, 221.
Mussel, 287, 377.
Mutton-fish, 254.
Mya arenaria, 23, 27, 159.
Mygale Hentzii, 167.
Myiadestes Townsendii, 34. [463.
Myiarchus crinitus, 584. M. Mexicanus,
Myiodioctes pusillus, 480.
Mylodon, 392.
Mylopharodon, 447.
Myobia, 493.
Myocoptes musculinus, 493.
Myriapods, 44, 103, 543.
Myrica gale, 130.
Mysis, 156.
Mysticetus, 52.
Mytilus, 245. M. cubitus, 287.

Narrow leaved Poplar, 408.
Nashville Warbler, 577.
Nassa obsoleta, 246.
Nasturtium officinale, 212.
Natica, 251, 504. N. clausa, 272. N. immaculata, 272.
Natidobia borealis, 160. N. lutea, 160.
Natural selection, 552.
Nauclerus furcatus, 645.
Nauplius, 432.
Nautilus, 236, 259.
Navicula, 317.
Negundo acceroides, 405, 415.
Neonympha Eurytris, 331. [476.
Neotoma cinerea, 296. N. Mexicana, 184,
Nepa, 369.
Nepenthes distillatoria, 13.
Nereis, 494.
Nerita polita, 4.
Neritina reclivata, 401.
Nerocila, 242.
Nerodia sipedon, 343.
Nesodon, 392.
Nettion Carolinensis, 83.
Neuronia semifasciata, 161.
Neuroptera, 44.
Night hawk, 11, 297, 298.
Night heron, 231.
Night raven, 171.
Nisoniades Brizo, 331. N. Catullus, 331. N. Juvenalis, 331. N. Persius.
Norman shell, 251.
North America, Extinct Flora of, 41.
Northern Shrike, 35.
Northern Titmouse, 74.
Northern Wax-wing, 579.
Nothrus ovivorus, 365, 366.
Noturus flavus, 297.
Nucula delphinodonta, 273. N. tenuis, 273. N. tumidula, 220.
Nudibranchia, 272.
Nullipores, 43.
Numenius borealis, 83. N. longirostris, 298.
Nut Pines, 185, 187.
Nyctale albifrons, 557. N. Richardsonii, 646. N. Tengmalmii, 646.
Nycterodius violaceus, 637.

Oak, 41, 503.
Obione canescens, 358.
Obscure Flycatcher, 417.
Ochtrodromus Wilsonius, 637.
Octopods, 259.
Oculina, 108, 500. O. explanata, 108.
Ocythoe, 237.
Odostomia producta, 273.
Œdema concinna, 616.
Oil Beetle, 96.
Oldenlandia cœrulea, 129.
Olive-backed Thrush, 573.
Onoclea sensibilis, 382, 448.
Ophibolus, 497.
Ophiocoma, 661.

Ophioglossum bullosum, 167. O. reticulatum, 167. O. vulgatum, 167.
Ophiuridæ, 216, 612.
Oporomis agilis, 574.
Orchids, 6.
Orchis spectabilis, 8.
Oracus, 53.
Orecchiale, 251.
Oregon Ash, 407.
Oregon Bear-wood, 407.
Oregon Grouse, 299.
Oregon Oak, 407.
Oregon Service-berry, 407.
Oregon Snow Bird, 77, 473.
Oregon Thrush, 31.
Oregon Yellow Fir, 410.
Oregon Yew, 414.
Oreortyx pictus, 185.
Oreoscoptes montanus, 73.
Origanum, 122.
Orioles, eggs of, 477.
Ormier, 251, 255.
Ornithodelphia, 607.
Ornithorhyncus, 501, 607.
Orthagoriscus mola, 218.
Ortyx Virginianus, 456, 512, 535.
Oryzopsis asperifolia, 155.
Oscines, 34.
Osprey, 569.
Ostenops Montezuma, 37.
Osteopygis chelydrinus, 89. O. emarginatus, 89. O. platylomus, 89.
Ostrea Virginica, 351, 401.
Otozoum, 612.
Ova and Pseudova of Insects, 490.
Ovis montana, 186, 296.
Owl, new species of, 478.
Oxygia reniformis, 123.
Oxyrrhopus, 497.
Oyster Catcher, 232.
Oysters, 88, 245, 354.

Pachymatisma Johnstoniæ, 451.
Pagurus, 261. P. longicarpus, 265, 266.
Painted Salamander, 158.
Palemon, 156.
Palæocoryne, 616.
Pale Bat, 472.
Pale Sparrow, 475.
Palestine and Syria, Flora of, 121.
Palmaceæ, 283, 350.
Palmated Crickets, 151.
Palmettos, 352.
Palms, 41, 284, 300.
Paludina lustrica, 161.
Pampas and Andes, 100.
Pandion Carolinensis, 569. P. haliaëtus, 569.
Pandora arctica, 277. P. trilineata, 272, [277.
Panyptila melanoleuca, 186.
Paper sailor, 236.
Paphrydia bullata, 499, 500.
Papilio Asterias, 330, 332. P. Calverleyi, 332. P. Philenor, 330. P. Troilus, 330. P. Turnus, 330.
Paradoxides, 45.
Paramecia, 110.
Parasites of Ascidians, 383.
Parasitic Acari, 389.
Partridge, 535.
Parus albescens, 299. P. atricapillus, 384. P. montanus, 75. P. occidentalis, 75. P. rufescens, 75. P. septentrionalis, 74, 299.
Passerculus Sandwichensis, 76. P. savanna, 507, 632.
Passenger Pigeon, 80.
Passer domestica, 635, 647.
Passiflora, 221.
Patella, 251.
Pavonia, 500.
Pea Hen, 279.
Pearl Oyster, 245, 251.
Pearls, 402.
Pecten dislocatus? 354. P. ventricosus, 249.
Pectinatella, 385.
Pediastrum, 323.
Pedicellina, 385, 441.
Pediœcetes phasianellus, 298.
Pelecanus erythrorhynchus, 640.
Penella, 241.
Penicillium, 110.
Penium, 321.
Penstemon digitalis, 163. P. grandiflora, 163.
Pentacrinus, 276, 496.
Penthina vitivorana, 152.
Perisoreus Canadensis, 80.
Perissoglossa tigrina, 578.
Peritresius, 88.
Perognathus parvus, 183. P. penicillatus, 476.
Persea Carolinensis, 401.
Petrels, 234.
Petromyzon Americanus, 20. P. Omalii, 220. P. Planeri, 220.
Peucaea æstivalis, 633. P. Bachmanii, 633.
Pewees, 185.
Peziza æruginosa, 503.
Phainopepla nitens, 34, 185.
Phalangidæ, 105.
Phalangium, 369.
Phallusia, 614.
Phanogenia typica, 216.
Philadelphia Vireo, 504.
Phillip's Jumping Rat, 477.
Philonthus, 99.
Phlectrophanes nivalis, 510, 585, 631.
Phlox maculata, 7.
Photinus? 615.
Phrenology, 586.
Phryganeidæ, 160.
Phrynosoma Douglassii, 298.
Phylactolæmata, 385.
Phyllopod Crustacea, 501.
Physa, 188, 650. P. ampullacea, 651. P. elonga, 651. P. gyrina, 651. P. heterostropha, 207, 417, 651. P. humerosa, 480, 651. P. Lordii, 651. P. virginea, 651.
Pica Hudsonica, 80, 297.
Picoides hirsutus, 572.
Picus pubescens, 384. P. scalaris, 474. P. villosus, 384.
Pied Duck, 383.
Pieris oleracea, 212, 330. P. Protodice, 212, 330. P. rapæ, 212, 330.
Pigeons, 185.
Pigmy Nuthatch, 74, 299.
Pig-weed, 97.
Pike, 126, 297.
Pike Perch, 126, 297.
Pileated Woodpecker, 572.
Pill-bugs, 45, 240.
Pimelia viridula, 221. [297.
Pimelodus allurus, 126. P. olivaceus, 126,
Pine, 74, 185, 212.
Pine Finch, 76, 226, 510, 582.
Pine Grosbeak, 75, 222, 384, 511, 581.
Pine Snake, 124.
Piney Point Shell-heaps, 463.
Pinicola Canadensis, 581. P. enucleator, 511, 581.

Pinna, 245, 246, 284. P. Carolinensis, 285. P. rudis, 285. P. squamosissima, 285.
Pinnaxodes Chilensis, 246.
Pinnixia chætopterana, 246. P. cylindrica, 246.
Pinnotheres maculatum, 245. P. margarita, 245. P. ostreum, 245.
Pinus abies, 219. P. Banksiana, 410, 416. P. contorta, 409, 419, 420. P. inops, 439. P. mitis, 439. P. monophyllus, 185. P. monticola, 410, 415, 419, 420. P. palustris, 287, 350, 400. P. ponderosa, 74, 80, 409, 411, 415, 418, 420. P. pungens, 324, 327, 548. P. resinosa, 410. P. rigida, 327, 409, 439. P. Sabiniana? 185. P. strobus, 410. P. læda, 400.
Pipa, 626.
Pipilo Abertii, 472. P. arcticus, 78, 296. P. fuscus, 472. P. Oregonus, 78.
Piping Plover, 231, 340, 341.
Pipit, 183.
Psicorvus Columbianus, 299.
Pisidium abruptum, 159. P. dubium, 159. P. variabile, 168.
Pitcher Plant, 13, 16, 211.
Pitch-pine, 287, 350, 409, 447.
Pituophis, 124. P. bellona, 478.
Pixy-purses, 285.
Plain Burbot, 18.
Plains of Kansas, 102.
Planorbis, 188, 650. P. Ammon, 480. P. dilatus, 669.
Plasticity of Pebbles and Rocks, 445.
Platanthera leucophea, 6.
Platanus Mexicanus, 185.
Plectrophanes, 298. P. ornatus, 76.
Plerodon, 91.
Plesiosaurs, 86, 609.
Plestiodon, 298.
Pleuronectidæ, 217.
Plexaura, 500.
Plexaurella, 500.
Pliocercus, 497.
Plover, 225, 344, 345, 348.
Poa, 155.
Pocillipora, 247, 500. P. cæspitosa, 246. P. elongata, 246.
Podasocys montanus, 183.
Podiceps occidentalis, 84.
Podura, 45.
Pogonicthys communis, 126.
Polar Hare, 115.
Polioptila melanura, 184. P. plumbea, 474.
Polyborus Audubonii, 480.
Polycistineæ, 428, 430.
Polydesmus erythropygus, 103. P. Virginiensis, 104.
Polygonatum latifolium, 672.
Polyommatus Porsenna, 330.
Polyps, 500, 543.
Polyzoa, 271, 385, 543, 611.
Pond-weed, 376.
Pontonia margarita, 245.
Poœcetes gramineus, 472, 631.
Poospiza Bellii, 184. P. bilineata, 189.
Poplar, 41, 212.
Poppy Mallow, 102.
Populus angustifolia, 408, 415, 416, 418, 421. P. balsamifera, 408, 419. P. monilifera, 409, 421. P. tremuloides, 409, 416, 419.
Porites, 352, 500.
Porpoises, 90.
Portulacaceæ, 37.
Porzana Noveboracensis, 639.
Posoqueria, Flowering of, 380.
Potamogeton natans, 375.
Potato, insects injurious to, 91.
Pouts, 489.
Prairie Dog, 156, 298.
Prairie Hen, 506.
Prairie Orchis, 6.
Prairie Pea, 162.
Prairie Warbler, 507, 578.
Prickly Ash, 283.
Prickly Pear, 164.
Prickly Poppy, 163.
Prideaux's Hermit Crab, 268.
Procellaridæ, 235.
Prochonias princeps, 89. P. strenuus, 89. P. sulcatus, 89.
Procyon Hernandezii, 186.
Propleura sopita, 88.
Proteus, 501.
Protococcus, 316.
Protophytes, 313, 314, 315, 562.
Protoplasta, 661.
Protozoa, 543, 651.
Prunus prostrata, 122. P. Virginiana, 415.
Psammogorgia, 500.
Pseudopodia, 430.
Psyche helix, 160.
Ptarmigan, 637.
Pteraster militaris, 666.
Pteris aquilina, 448. P. critica var. albolineata, 560. P. serrata, 560.
Pterogorgia, 500.
Pteropods, 43.
Pterosauria, 609.
Ptychocheilus lucius, 480.
Puma, 465.
Pupipara, Development of, 490.
Purple Finch, 76, 292, 581.
Purple Gallinule, 498.
Purple Grackle, 508.
Purple Martin, 228, 554.
Purple-throat Humming Bird, 188.
Purpura, 251.
Putorius longicauda, 299.
Pycnogonids, 371, 433.
Pyrameis Atalanta, 212, 331. P. cardui, 212, 331. P. Huntera, 212, 331. [33.
Pyranga æstiva, 478, 578. P. Ludoviciana,
Pyrethrum densus, 122.
Pyrocephalus Mexicanus, 477.
Pyrulidæ, 286.
Pyrus fraxinifolia? 406, 419, 420.
Pythonomorphs, 84.

Quadrumana, 608.
Quadrupeds, 143, 144, 145.
Quahaug, 464.
Quails, 183, 476, 512.
Quaternary Beds of Sweden, 219.
Quaternary Period, 501.
Quercus, 438. Q. agrifolia, 184. Q. castanea, 560. Q. Ganyana, 407. Q. macrocarpa, 407. Q. monticola, 560. Q. virens, 398.
Quiscalus baritus, 287, 636. Q. major, 636. Q. versicolor, 508.

Raccoon, 186.
Racodium xylostroma, 112.
Radiates, 43, 240, 291, 442.
Radiolaria, 108, 430, 661.
Raia, 285. R. batis, 621.
Rallus crepitans, 48, 601.
Ramphocœles icteronata, 37. R. passerina, 37. R. sanguinolenta, 37.
Rana halecina, 125.
Ranunculus aquatilis, 376. R. demissus, 122. R. Purshii, 6.

Rattlesnake, 124, 157, 164, 208, 475.
Raven, 79, 183.
Red backed salamander, 158, 378.
Red bellied Nuthatch, 74, 581.
Red-bellied Woodpecker, 581.
Red bird, 635.
Red-breasted Merganser, 233.
Red-bud, 8.
Red Crossbill, 76, 299, 583.
Red-eyed Vireo, 292.
Red field clover, 97,
Red Fir, 411.
Red Hawthorn, 407.
Red Maple, 130.
Red-necked Woodpecker, 475.
Red owl, 334.
Red-poll Finch, 583.
Red-shouldered Hawk, 396, 517.
Red-spotted lake trout, 127.
Redstart, 33, 295.
Red-tailed Black Hawk, 184.
Red-tailed Hawk, 384, 393.
Red-winged Blackbird, 78, 291, 294, 508.
Redwoods, 350.
Regeneration of Limbs 390.
Regulus calendula, 32. R. satrapa, 32.
Reindeer, 548.
Renilla, 500.
Reptiles, 609.
Rhamesus, 407.
Rheumatism in Prehistoric times, 55.
Rheumatism Root, 129.
Rhinocryptis, 609.
Rhizocrinus, 108, 276, 496, 661. R. Lofotensis, 275, 666.
Rhizopoda, 108, 428, 430.
Rhizostomida, 279.
Rhus glabra? 405, 421.
Rhyacophilus solitarius, 638.
Rice paper 562.
Richardson's Pewee, 31, 480.
Ring Plover, 231, 340, 341.
Robin, 267, 573.
Robin Thrush, 31.
Rock Swift, 186.
Rock Wren, 73, 183, 297.
Rocky Mountain and Alpine region, 440.
Rocky Mountain Golden-eye, 83.
Roseate Tern, 234, 643.
Rough-legged Buzzard, 227.
Rough-legged Hawk, 518.
Ruby-crowned Wren, 32.
Rudbeckia, 8.
Ruffed Grouse, Eggs of, 49, 82, 105, 384.
Rufous-backed Titmouse, 75.

Sabal, 41.
Saccata, 258, 441.
Sagacity of Purple Martin, 554.
Sagartia carcinophila, 250. S. paguri, 248.
Sage Brush, 356.
Sage Fowl, 82, 188.
Sagittaria, 36, 211.
Salamanders, 157, 501, 629.
Salisburia, 41.
Salix, 130, 219, 408. S. Fendleriana, 408. S. Hookeriana, 408. S. longifolia, 408.
Salmo canis, 127. S. fontinalis, 519. S. Gibbsii, 127. S. iridea, 519, 520, 521. S. Lewisii, 125. 297. S. spectabilis, 127. S. Suckleyi, 126.
Salvadora Grahamii, 478.
Salvia, 357.
Salpinctes obsoletus, 183, 297.
Sambucus Canadensis, 382. S. pubens, 382.
Sanderling, 638.
Sand-crab, 342.
Sand flea, 45.
Sand Martin, 116, 228.
Sand pipers, 232, 346.
Sandwich Tern, 644.
Sanguinaria Canadensis, 129.
Sarcopsylla (Pulex) penetrans, 386
Sarcoptes, 371, 390. S. scabiei, 372, 373.
Sarracenia, 17. Double Flowered, 48. S. purpurea, 48, 211, 327.
Sassafras, 41, 130, 412. S. officinale, 130.
Satyrus Alope, 331. S. Nephele, 331. S. Portlandia, 331.
Saurians, 164, 661.
Sauropsida, 607.
Saururæ, 609.
Savannah Sparrow, 230, 507, 632.
Savin, 130.
Saw-palmetto 283.
Saxidomus gracilis, 4.
Saxifraga aizoon, 382. S. Virginiensis, 129, 327.
Sayornis nigricans, 183.
Scalaria Greenlandica, 273.
Scallops, 354.
Scaphirhynchus platirhynchus, 126.
Scapteriscus, 151.
Scarlet Flycatcher, 477.
Sceloporus magister? 478.
Schrankia, 163.
Scilla, 300, 301.
Scirpus sylvaticus, 101.
Sciurus leporinus, 186.
Scolecida, 543.
Scolecophagus cyanocephalus, 79.
Scolopax Wilsonii, 83.
Scolopendra, 103, 104.
Scolopocyptops 6-spinosa, 104.
Scomber grex, 220.
Scopelus Krøyeri, 220.
Scops asio, 384.
Scorpions, 365.
Scoter, 383.
Scrub oak, 212.
Scutibranchiata, 251.
Scutigeridæ, 104.
Scyllium, 285, 620, 630.
Sea anemones, 156, 247, 263.
Sea cucumber, 467.
Sea daisies, 266.
Sea ducks, 233.
Sea ears, 250.
Sea lettuce, 265.
Sea lily, 275.
Sea serpents, 84.
Sea spider, 264, 265, 371, 433.
Sea swallow, 339, 342.
Sea urchin, 246, 285.
Sea weeds, 284.
Sedges, 6.
Seiurus aurocapillus, 586. S. Ludovicianus, 577. S. meridionalis, 635. S. Novæboracensis? 32.
Selachians, 617.
Semnopithecus, 501.
Sepia, 237.
Sequoias, 350.
Serin Finch, 635.
Serinus meridionalis, 647.
Serpents, 482, 483.
Service-berry, 81.
Setophaga ruticilla, 33, 294.
Seventeen-year Cicada, hatching of, 106.
Shaddock, 400.
Sharks, 501, 617.
Sharp-tailed Finch, 634.

Sharp-tailed Grouse, 82.
Shearwater Puffin, 235.
Sheep's head, 401.
Sheldrake, 84.
Shining Flycatcher, 185, 472.
Shore Lark, 295, 297.
Short-tailed Tern, 644.
Shovel-nosed Sturgeon, 126.
Showy Orchis, 8.
Shrikes, 34, 295, 476.
Shrimp and Prawns, 45, 156.
Sialia arctica, 32, 189. S. Mexicana, 32, 185. S. sialis, 32, 159.
Sibbaldias, 277. S. laticeps, 278. S. tectirostris, 278.
Sida, 163.
Siderastræa, 500.
Sigaretus, 251.
Silver Maple, 130.
Silvery Tern, 339.
Singing mouse, 551.
Sinus terminalis, 624.
Siphonaria, 287.
Siren, 628.
Sitta aculeata, 74. S. Canadensis, 74, 581. S. Carolinensis, 384, 556. S. pygmæa, 74, 299.
Skate, 285, 617, 622, 623, 624, 625, 627.
Skua Gulls, 235.
Skunks, 186.
Skunk Cabbage, 128.
Small Bittern, 179.
Small Brown Pheasant, 82.
Smaller Blue Heron, 231.
Small-headed Flycatcher, 577.
Smilax, 212.
Smooth Maple, 406.
Smooth Sumac, 405.
Smynthurus, 45.
Snails, 184.
Snake, 36.
Snake-bird, 41.
Snipe, 225, 233.
Snow Bird, 510.
Snow Bunting, 384, 510, 585.
Snow-crystals, 302, 303, 306.
Snowy Egret, 231.
Snowy Heron, 637.
Soldier-crab, 247.
Solidago, 8.
Solitary Tattler, 232.
Solitary Vireo, 507, 579.
Song Sparrow, 10, 183, 230, 292, 293, 479, 507.
Sooty Tern, 644.
Southern Buckthorn, 400.
Sow bugs, 240.
Spanish Bayonet, 460.
Spanish Dagger, 164.
Spanish moss, 282.
Sparrow Hawk, 516.
Spatangus, 661.
Speckled Trout, 519.
Spectrum of the fire-fly, 615.
Spermophila badiiventris, 37.
Spermophilus Beecheyi, 182. S. Franklinii, 208. S. Harrisii, 188.
Sperm whale, 334.
Sphærium striatinum, 297, 417.
Sphenopus, 216.
Sphyrapicus nuchalis, 475. S. varius, 571. S. Williamsonii, 475.
Spice wood, 130.
Spiders, 45, 167, 365.
Spider and Mud-wasp, 391.
Spider Crab, 264.
Spiderwort, 163.
Spiranthes, 6.
Spiræa, 327.
Spizella pallida, 299.
Spizella Brewerii, 77. S. monticola, 634. S. pallida, 77, 475. S. socialis, 77, 295, 473, 476, 508, 582, 634.
Splanchnotrophus brevipes, 241. S. gracilis, 241.
Sponges, 244, 449, 450, 451.
Spongilla fluviatilis, 454.
Sporangium, 313, 323.
Spotted Bitterns, 177.
Spotted Burbot, 18, 20.
Spotted Frog, 125.
Spotted Sandpiper, 232.
Spring Beauty, 130.
Spring Cress, 130.
Spruce Partridge, 512, 636.
Squalodon, 444.
Squid, 258.
Squill, 122.
Squilla, 243.
Squirrel, 141, 142, 208, 478.
Squirrel Hawk, 183.
Stachys, 122.
Stake-driver, 170.
Starfish, 131, 156.
Staurastrum, 323.
Steller's Jay, 80.
Sterna antillarum, 340. S. argentea, 339. S. cantiaca, 644. S. flavida, 644. S. frenata, 340. S. hirundo, 641. S. macroura, 642. S. menuta, 339. S. paradisea, 643.
Stickleback, 488.
Stilt Sandpiper, 339.
Stizostedion boreus, 126, 297.
Stolonoclypus prostratus, 663.
Stramonium, 128.
Strawberries, 50, 328, 669.
Striker, 339.
Striped Blister-beetles, 99.
Striped Cantharis, 96.
Strix pratincola, 513, 570, 646.
Strombocarpa pubescens, 471.
Strombus, 532. S. alatus, 466. S. gigas, 444.
Sturnella magna, 509. S. neglecta, 79, 473, 509.
Stylops, 434.
Succinea, 188.
Suckley's Salmon Trout, 126.
Sulphur bottom, 334.
Summer Redbird, 478, 578.
Summer Yellowbird, 477.
Sundew, 211.
Sun-fish, 218.
Surnia ulula, 569.
Swainson's Thrush, 31.
Swainson's Warbler, 576.
Swallow, 33, 117, 118, 119, 228.
Swallow-tailed Hawk, 645.
Swamp cowslip, 211.
Swamp Sparrow, 229, 473, 507, 634.
Swan, 83, 473.
Sweet Bay, 400.
Sweet Tern, 130.
Sweet Gale, 130.
Swift, 246.
Swift Fox, 476.
Sychnocephala, 101.
Sygnathus typhle, 220.
Symphemia, 233.
Symplocarpus fœtidus, 128.
Syria, 123, 124.
Syrnium cinereum, 570. S. nebulosum, 384.
Syrphus fly, 95.

Tachina, 99.
Tænia, 42.
Tapaga Douglassii, 124.
Tapes gracilis, 4.
Tantalus loculator, 481.
Taphrosphys molops, 89, 90.
Tarantula, 167.
Tardigrades, 373, 493.
Tatler, 225, 233.
Taxidea Americana, 186, 476.
Taxidermy, Hints on, 136, 137, 138, 139, 189, 481.
Taxodium distichum, 456.
Taxus baccata, 130. T. brevifolia, 414, 419. 420. T. Canadensis, 414.
Teals, 506.
Telinga maloli, 250.
Tellina, 402. T. tenera, 273.
Tengmalm's Owl, 646.
Tennessee Warbler, 222, 331, 496, 575.
Teratology, 152, 153, 154.
Terebratulidæ, 108.
Terebratulina, caput-serpentis, 108. T. septentrionalis, 273, 385.
Terias Delia, 330. T. Lisa, 330.
Termites, 360.
Terns, 226, 234, 344, 345, 347.
Tertiary, 415.
Tetragontheca, 122.
Tetrallia, 247.
Tetranychus holosericeum, 369. T. telarius, 369.
Tetrao Columbianus, 82. T. Franklinii, 81. T. obscurus, 81, 298. T. umbellus, 384.
Tetraplodon australis, 329.
Teucrium, 122.
Texan Nighthawk, 189, 477.
Textillariae, 659.
Thalassidroma Leachii, 234. T. Wilsonii, 234.
Thalictrum anemonoides, 382.
Thecachampsa, 90. T. sericodon, 91. T. sicaria, 91.
Thecla Acadica, 330. T. Auburniana, 212, 330. T. Augustus, 212, 330. T. Falacer, 330. T. Henrici, 212, 330. T. humuli, 330. T. Mopsus, 330. T. Niphon, 212, 330. T. Pembina, 330. T. strigosa, 330. T. Scudderii, 330. T. Clothilde, 330.
Themisto, 243.
Thomomys fulvus, 477. T. umbrinus, 183.
Thoracosaurus, 91.
Thorius pennatribus, 222.
Thorn-apple, 93.
Thracia Conradi, 277.
Thriothorus leucogaster, 474.
Thrush, 295.
Thuya gigantea, 413, 419, 420.
Thyasira Gouldii, 272.
Thylacinus, 53.
Ticks, 370.
Tigrisoma Braziliensis, 178, 179. T. melanolopha, 178. T. tigrina, 177.
Titmouse, 511.
Toad, 125, 629.
Toad fish, 242.
Todarus, 237.
Tomato, 93.
Toothache tree, 233.
Top shell, 251.
Tortoises and turtles, 481.
Torula, 110.
Tosia, 661.
Towhee bunting, 292.
Townsend's Flycatcher, 34.
Townsend's Hare, 115.
Toxodon, 392.
Toxopneustes Dröbachiensis, 663.
Trachelius, 110.
Tragacanth, 122.
Trapezia, 247.
Trebius, 241.
Tree Sparrow, 634.
Trichina, 42. T. spiralis, 240.
Trichopterygidæ, 213.
Trichotropis borealis, 274.
Tridacna, 246.
Trifolium repens, 381.
Trilobite, 45.
Trillium erythrocarpum, 102, 382.
Trimerella, 216.
Tringa, 506, 512.
Trionyches, 90.
Trionychidæ, 88.
Trionyx lima, 90.
Triticum violaceum, 155. T. vulgare, 155.
Tritonium pygmæum, 274.
Tritons, 374, 489, 501.
Trochus, 252.
Troglodytes ædon, 49, 390, 614. T. hyemalis, 74.
Trogoderma, 307.
Trombidium, 369.
Trophon Morchii, 220.
Trout, 202, 288, 297, 519.
Trunk-fish, 467.
Trega, 25.
Turbo, 251.
Turbonilla umbilicaris, 220.
Turdus Aliciæ, 574. T. fuscescens, 574. T. migratorius, 31, 297, 573. T. nævius, 31, 75, 513, 572. T. Pallasi, 573. T. Swainsonii, 31, 295, 573, 574. T. ustulatus, 31.
Turnstone, 232.
Turritella erosa, 273.
Turtles, 374.
Twin leaf, 129.
Twisted Pine, 409.
Typhlodromus pyri, 366, 373.
Tyrannus Carolinensis, 390. T. Dominicencis, 645. T. verticalis, 184, 309, 477. T. vociferus, 184.
Tyroglyphus, 367, 371. T. feculæ, 389. T. siro, 491.

Ucia canescens, 122.
Ulva latissima, 131, 265, 376.
Unio, 26, 27, 159, 417. U. complanatus, 27. U. crassus, 54. U. Jewettii, 402. U. luteolus, 297, 417. U. margaritiferus, 402. U. metanevra, 54. U. plicatus, 54. U. rectus, 54.
Upland Plover, 232.
Urodela, 609.
Uropoda, 369.
Ursus horribilis, 186.
Urticina crassicornis, 243.
Utricularia inflata, 375. U. intermedia, 616. U. minor, 375. U. vulgaris, 375.

Vaccinium, 212.
Valvata arenifera, 160.
Vanbenedenia Kröyeri, 220.
Vanessa Antiopa, 331, 616. V. interrogationis, 212. V. c-album, 331. V. Milberti, 212, 331.
Varied Thrush, 513, 572.
Velutina, 271. V. haliotoides, 272.
Venus, 249.
Venus's ear, 250.
Verbena, 103.
Vespa maculata, 52.

Vespertilio, 472. V. Yumanensis? 480.
Virginia Rail, 231.
Viola, 439. V. blanda, 129, 155, 381. V. cucullata, 6, 129, 609. V. ebracteolata, 122. V. rotundifolia, 130. V. sagittata, 130. V. Selkirkii, 155, 381.
Violets, 6, 8, 212.
Vireo, 34, 35, 296. V. Bartramii, 35. V. Novæboracensis, 507, 579. V. olivaceus? 35. V. pusillus, 186. V. solitarius, 478. V. sylvia gilva, 504. V. sylvia Philadelphica, 504.
Virginia Partridge, 536.
Vision of Fishes and Amphibious Reptiles, 107.
Vitrina, 251.
Vivipara contectoides, 534. V. Georgiana, 534. V. intertexta, 533. V. subpurpura, 534.
Volute, 252.
Vorticella, 110.
Vulpes littoralis, 186. V. velox, 476.
Vulture Eagle, 480.

Waldheimia cranium, 108.
Walrus, 333.
Wampum, 4.
Warbling Vireo, 35, 504.
Water lily, 376.
Water Ouzel, 32.
Water-snake, 343.
Water starwort, 212.
Water Thrush, 32.
Water-turkey, 42.
Waxwing, 34.
Weasel, 279, 299.
Wentle trap, 273.
Western Bluebird, 32, 185.
Western Crow, 79, 183.
Western Flicker, 183.
Western Grackle, 79.
Western Grebe, 84.
Western Larch, 412.
Western Lark, 79.
Western Meadow Lark, 509.
Western Mountain ash, 406.
Western Pogue-birch, 408.
Western Red-tailed Hawk, 295.
Western Song Sparrow, 77.
Western Sugarberry, 407.
Western Tanager, 33.
Western Titmouse, 75.
Western White pine, 410.
Whale-louse, 244.
Whales, 52, 217, 333, 334.
Whippoorwill, 11.
White Ants, 360.
White Arethusa, 381.
White-bellied Auk, 186.
White-bellied Nuthatch, 556.
White-bellied Swallow, 116, 228.
White-bellied Wren, 474.
White-breasted Nuthatch, 384.
White creeper, 292.
White crowned Sparrow, 77, 580, 633.
White-eyed Vireo, 292, 507, 579.
White fish, 126.
White-headed Eagle, 183, 227.
White Heron, 401.
White-throated Sparrow, 510, 633.
White winged Crossbill, 76, 222, 384.
Whooping crane, 401.
Wild Cat, 186, 477.
Wild Hyacinth, 162.
Wild mustard, 162.
Wild Pigeon, 295.
Wild Turkey, 456, 506.
Willet, 233.
Williamson's Spruce, 412.
Williamson's Woodpecker, 475.
Willow, 41, 130, 185, 408.
Wilsonia minuta, 577.
Wilson's Albany, 329.
Wilson's Plover, 231, 338, 340, 637.
Wilson's Snipe, 83, 222.
Wilson's Tern, 234.
Wilson's Thrush, 292.
Winter Cress, 130.
Winter Wren, 74,
Woodcock, 232.
Woodhouse's Toad, 478.
Wood Ibis, 481.
Wood mice, 183.
Woodpecker, 12, 297, 422.
Wood rat, 184, 296.
Wood ticks, 370.
Wood Thrush, 292, 293.
Worm eating Warbler, 556, 576.
Worms, 156, 240, 494.
Wormwood, 357.
Wren Titmouse, 185.

Xanthidia, 323.
Xanthocephalus icterocephalus, 636.
Xanthoxylum Carolinianum, 283.
Xema atricilla, 234.
Xerobates Agassizii, 189, 478.
Xylobius, 45.
Xylostroma giganteum, 112.

Yellow Bird, 76, 292, 583.
Yellow-bellied Flycatcher, 230, 504, 572.
Yellow-billed Cuckoo, 570.
Yellow-billed Woodpecker, 571.
Yellow-breasted Chat, 477, 479.
Yellow-crowned Night Heron, 637.
Yellow-headed Blackbird, 636.
Yellow-headed Titmouse, 474, 476.
Yellow Ladies' Slipper, 8.
Yellow-legs, 83.
Yellow Pine, 80, 409.
Yellow Rail, 639.
Yellow Warbler, 292, 293.
Yellow-winged Sparrow, 507.
Yoldia limatula, 273.
Yucca, 164, 187, 460. Y. baccata, 187.

Zaphrentis, 216.
Zebrilus undulatus, 178, 179.
Zenaidura Carolinensis, 81, 295.
Zoëa, 45, 433.
Zoe pelagica, 433.
Zonotrichia albicollis, 510, 633. Z. Gambelii, 77. Z. leucophrys, 77, 550, 581, 633.